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The Future in Canada.

IN this issue we publish a review of an important aspect of the Canadian situation by MR. A. S. L. BARNES, our Canadian Correspondent, in the belief that British electrical manufacturers who are concerned with overseas markets will find in it some guidance in arriving at conclusions regarding the possibility of selling their goods in Canada.

In the first place, Mr. Barnes shows, as we have shown before, of what tremendous proportions the Canadian electrical industry is for a country with a population of less than ten millions. In hydro-electric development work involving a capital expenditure of $2,110 millions is likely to be carried out in the next few years. As it is calculated that about six times this amount will be expended in the application of the power so developed, the stupendous total of $15,000 millions (£3,000,000,000) is arrived at.

Where will this huge amount be spent? Is Canada herself capable of meeting the needs which will arise? Or is the United States to secure the lion's share of what must be brought in from beyond the Dominion's borders?

The answer to the first question is, we think, that while the Canadian manufacturing industry will grow with the development of the country's hydro-electric sources, there will still be a large importation of electrical goods. The answer to the second question involves consideration of the three parties chiefly concerned—Canada herself, the United States and Great Britain.

Canada still has a favourable sentiment towards this country, but her proximity to the United States, and the consequent infiltration of American ideas, has had an influence which, although not necessarily anti-British, has not tended to strengthen the Empire tie. Moreover, that same proximity has made it easy for American manufacturers to maintain efficient branches with adequate "service" facilities. Then American capital has secured a dominating position in Canadian industry by the establishment of factories and by participation in water-power development.

A very casual survey of the situation is sufficient to assure the observer that the dice are heavily loaded against this country. There are, however, one or two other considerations in the opposite direction. The recent increases in the American import duties have not

pleased Canadians and may have some effect upon relations. Again, the difficulties arising out of our distance from the Dominion are partly off-set by the preference which Canada affords British goods. So far as electrical products are concerned this amounts to 50 per cent.; that is, under the preferential tariff we pay only two-thirds of the rate imposed under the general tariff. The duties are, of course, still high enough to give Canadian manufacturers substantial protection, but where the market is open this preference is of value.

Where it is possible, however, it appears that it will become more and more essential for British manufacturers to set up establishments in Canada. Mr. Barnes shows that the Dominion would welcome the influx of more British capital, and several British electrical manufacturing companies are finding the market a profitable one.

It would seem that strong British trading representation is the first step to be taken after a serious study of the market for a particular line. This means adequate stocks, quickly-available replacement parts and a trained staff, constantly and thoroughly backed up by the principals at Home. Having thus gained a footing, the possibilities of further expansion could be gauged with greater assurance and the question of setting up a works in Canada could be considered in the light of the experience gained.

We realise that the way is not easy and that the expenditure of much money is involved. But if we are not to lose the electrical market to Canadian and American concerns some such steps will have to be taken It cannot be doubted that the market is one of the most promising in the world and that there is room for the British manufacturer if by himself, or in co-operation with others, he will take the necessary steps.

The Fulham Inquiry.

WHEN discussing a few weeks ago the nature of the opposition to what is in effect the erection of a new power station at Fulham we anticipated that the objection entered by the London County Council would be justified as a means of securing its right, as guardian of the public interest, to make suitable representations. The Council had clearly been influenced by the course of events at Manchester—we think, not unreasonably. The present occasion is the first on which the question of the elimination of sulphurous acid has loomed largely in an official inquiry; this makes the proceedings of first-class importance to the electrical industry, and we have therefore devoted several columns to the inquiry in this and last weeks' issues. The main recommendation of the L.C.C., that the Commissioners should give their consent only if they were satisfied that no hurt to London would ensue through the emission of sulphur fumes, seems to us one that ought to be acted upon. Indeed, the suggestion was first put forward on behalf of the Fulham Borough Council, whose representatives astutely answered in advance the chief questions afterwards raised by the opposition. These tactics made the later days of the inquiry appear somewhat of an anti-climax. Witnesses against the scheme were easily able to prove the soundness of the general principle that power stations should be constructed away from urban areas, and also the ill effects of atmospheric pollution. Earlier evidence had, however, shown that in the first case the general principle (which is not the same thing as dogma) could not apply for very good reasons, and that the danger from sulphur-fumes would be non-existent. With regard to the latter, although it can hardly be admitted as evidence, we cannot refrain from commending the spirit shown in MR. J. H. RIDER'S dictum that he would have a very poor opinion of engineers and chemists if an effective means for preventing nuisance could not be provided.

The tests of the sulphur-elimination plant at Fulham have been made over a very brief period and, although the results so far have been good, their limited scope might have constituted a serious weakness in the case but for the offer by the promoters to substitute, if necessary, the process approved for the Battersea station by the committee presided over by the Government chemist.

It is this safeguard which we think makes totally unnecessary the holding up of the work, as was suggested by some witnesses, pending further tests on a larger scale. It has been shown that the new station will be required to cope with the load anticipated in less than three years' time. It should be borne in mind also that estimates made in 1921 of the growth of load in London have been actually very much less than the figures attained, and we think it is quite likely that the more recent estimates also will be found to have understated the future position. Delays may therefore prove more than usually dangerous.

The Improvement of Hotel Lighting.

THE lamp makers have asserted that the electric lamp (particularly the vacuum type) lasts too long. The last E.D.A. Conference reminded us of this, for it is in hotels that one can see ample proof of the assertion.

Those with experience of hotels recall with a shudder the ancient, dim, underwatted lamp with an inefficient shade, in a most inconvenient position, which is the general rule. Even where a second lamp is provided for the bed it is usually placed in a position to cast its rays full into the eyes instead of being behind the head. How many of us have had to adopt the wicked expedient of a string attached to the doorside switch in the absence of a switch reachable from the bed? (Indeed, we remember one hotel where the string was adopted by the management as standard practice.)

In the restaurants and public rooms conditions are not so deplorable, but this is merely speaking comparatively for there is tremendous scope for improvement in all directions. Even the best of hotels do not err on the side of extravagance in the illumination of their apartments, and from experience we heartily agree with the strictures passed upon them by MR. R. C. HAWKINS.

The suggestion that the next E.D.A. or E.D.A.-E.L.M.A. Campaign should be directed towards the improvement of hotel lighting is an excellent one, and we see no reason why such a Campaign should not also aim at encouraging the many other uses which can be found for electricity in a hotel, as suggested by LT.-COL. VIGNOLES.

Examples of good lighting in any public or semi-public institution have an educative effect upon visitors, quite apart from the direct results obtained by the industry from improvements in the lighting of such institutions.

Power Factor Improvement.

IN the study of phase advancers contained in the paper read by DR. J. J. RUDRA and PROFESSOR MILES WALKER before the I.E.E., reference was made to the feeling that undoubtedly exists against the use of a commutator with alternating-current machinery. We think this prejudice—for that is what it really is in these days—owes its origin partly to the efforts of consumers' engineers in the first decade of the century to popularise the induction motor in place of the tried and then more popular d.c. machine, and partly, it must be owned, to the relatively poor performance of some of the earlier a.c. commutator machines.

Consideration of power factor is now more than ever opportune in view of the effect of using existing transformers on systems whose frequencies are to be changed from lower values to the standard. During the discussion of the paper referred to, MR. L. J. HUNT mentioned the alternative method of phase correction by capacitors, amplifying the remarks he made on this point from the chair at the meeting of the London Students' Section, which was reported by us last week.

One of the advantages of alternating-current transmission is that the need for rotating plant is thereby avoided, and the logical conclusion, which may be deferred for many years, is surely the elimination of everything that is not static between the prime mover which converts mechanical to electrical energy and the motor which reverses this process.

Canadian Electrical Industry.

What parts can British capital and British electrical manufacturers play in the immense future expansion?

By A. S. L. BARNES, A.M.I.E.E.

IN the ELECTRICAL REVIEW of August 29th last there appeared an editorial under the heading "World Developments" in which reference was made to Canada and to the great hydro-electric power developments which are in actual progress now or are planned for the very near future; mention was made, also, of the need for capital for these huge undertakings. A general review of the whole situation will no doubt be of interest. Being an engineer, the writer did not feel competent to discuss financial matters without outside aid, and so the services of others, whose opinions should be of real value, were enlisted—as will be evident later.

As the editorial referred to above pointed out, it has been estimated that the capital expenditure on hydro-electric developments in Canada will probably be about £20,000,000 a year for the next three years. According to the Canadian Department of the Interior, there is a large programme of construction in hand, from the Atlantic to the Pacific, involving installations aggregating more than 1,680,000 h.p.—a greater figure than has ever before been in view at any one time. Furthermore, it is stated that many of these installations comprise the initial stages only of the respective undertakings, and when such plants reached their ultimate designed capacity, a further 2,000,000 h.p. will have been added to the Dominion's total.

Canada is now becoming so well known to engineers and others at home that a detailed tabulation of the numerous developments will be full of meaning to many; the following table has therefore been compiled from information published by the Department of the Interior:—

Province.	Company.	Site.	Initial development (horse-power).	Date to commence operation.	Ultimate development (horse power).
British Columbia ...	B.C. Power Corporation and Subsidiaries	Stave River	47,000	Autumn, 1930	188,000
		Bridge River	80,000	1932	600,000
		Jordan River	Fourth unit 18,000 H.P. being added	1930	—
	Powell River Co.	Lois River	22,000	1931	44,000
*Alberta	Calgary Power Co.	Ghost River	18,000	—	18,000
Saskatchewan ...	Churchill River Power Co.	Island Falls Churchill River	42,000	Began operation June, 1930.	84,000
Manitoba	North-Western Power Co.	Seven Sisters Falls Winnipeg River	112,500	1931	225,000
	City of Winnipeg.	Slave Falls Winnipeg River	24,000	September, 1931	96,000
†Ontario	†Hydro-Electric Power Commission of Ontario	Nipigon River	54,000	1930	—
		Niagara Falls	Tenth unit at Queenston—58,000 H.P.	Autumn, 1930	—
	H.E.P.C. of Ontario and Chats Falls Power Co.	Ottawa River	224,000 Half for Ontario Half for Quebec	End of 1931	—
	Hudson's Bay Power Co	Abitibi River	275,000	Autumn, 1932	—
	Canada Northern Power Co.	Montreal River	13,000	1930 (?)	—
	Algoma District Power Co.	Michipicoten River	11,000	Unit recently added	—
Quebec	Beauharnois Light, Heat and Power Co.	St. Lawrence River	200,000	October, 1932	500,000
	Shawinigan Water and Power Co.	Upper St. Maurice River	160,000		
		Grand Mère Plant	25,000	—	—
		La Gabelle Plant	30,000		
	Alcoa Power Co.	Chute à Caron Saguenay River	260,000	1931	—
	James MacLaren Co.	High Falls Lièvre River	90,000	1930 (?	120,000
Nova Scotia ...	Nova Scotia Power Commission.	Mersey River	7,600 10,600 12,700	Recently completed	—
New Brunswick ...	St. John River Power Co.	Grand Falls St. John River	60,000	Recently completed	—

* Details from *Electrical News and Engineering.*

† It was announced recently by a member of the Ontario Government that it is intended (apparently in the near future) to develop power in Northern Ontario on the falls between the Mississauga and Ottawa rivers. About 485,000 h.p. is available altogether.

‡ The Hydro Electric Power Commission has just contracted for all the power that Quebec does not require.

Electrical News and Engineering (Canada), in a recent issue, gave details covering many of the foregoing items, but including under the heading of "Developments in Progress and in Immediate Prospect" some additional ones. These details give the developments under construction as totalling 2,162,000 h.p., and ultimate developments 9,373,000 h.p., the latter figure including 4,000,000 h.p. from the St. Lawrence River; commencement of work on this river is perhaps hardly "in *immediate* prospect" (except for the work

already undertaken by the Beauharnois Power Co.), although it seems now to be a possibility within a comparatively short time. After arriving at the sum of $2,110 millions as the capital required for the development of this large amount of power, by allowing $225 per horse-power, the *Electrical News* goes on :—

"According to estimates supplied by the director of the Dominion Water Power and Reclamation Service, Ottawa, the amount required to develop, transmit, and distribute power is only 14 per cent. of the capital involved, the 86 per cent. being required in the application of this power. This means that for the 9,373,000 h.p. now under construction and planned for in the near future, for its ultimate application, a total investment of $15,000,000,000 (£3,000,000,000) will be required to develop and apply this power."

According to the above statement, this stupendous activity in hydro-electric development will mean, indirectly, to the electrical industry, in wiring, lamps and accessories. fixtures, motors and their auxiliary equipment, electric signs, heaters and appliances of all kinds, electric ranges, &c., the spending of nearly $13,000,000,000 out of the total sum mentioned above. Based on past experience in Canada, it is safe to say that this power will be all absorbed within a short time of its being made available.

Canada is particularly fortunate not only in having immense water-power resources, but also in the fact that a large portion of these resources is located within commercial transmission distance of the larger centres of population, of the mining areas, and of the forests where pulpwood requiring large amounts of power for its manufacture into paper pulp, is available.

By courtesy of the High Commissioner for Canada.]

The Point du Bois Power Development, Winnipeg River, Manitoba.

The rate of progress of power development in this country has been astonishing, as the following figures show :—

Year.	Developed water power (horse power).
1900	173,000
1920	2,500,000
1929	5,730,000

In view of the fact that by 1932 or 1933 perhaps 2,000,000 h.p. will have been added to the 1929 figure, it is not unreasonable to expect that that same figure will have been doubled by 1940 or soon after. Having indicated how extensive is the field of electrical development in Canada, it is appropriate to give some consideration to the financial side of the matter.

The writer has consulted various financial experts with regard to the question whether British capital can be employed in some of these great projected undertakings, and quotations from their letters follow. It may be noted first, however, that while, of the varied industries of Canada, the pulp and paper industry stands first, the second is that of electrical apparatus and supplies, and the third electric light and power. So far as the second industry is concerned, Canada is very well equipped for supplying practically all her requirements in the way of turbines, generators, transformers, and transmission and distribution line equipment. Practically all equipment required for the great developments now in progress—generators and transformers of the largest size, transmission line equipment for the highest voltage, &c., can all be made here, and for British manufacturers to obtain an appreciable share of such work, or even any of it, there would have to be some decided advantage to the purchasers in price, delivery, efficiency, or other factor. Of smaller apparatus, such as domestic electrical appliances, small motors, and electric lighting fittings, this country imports great quantities, chiefly from the United States, although a large and increasing proportion of the total is manufactured here.

The following quotations are from letters received from some of the largest financial houses, and one of the most important banks, in Canada :—

"For some years past the securities of Canadian hydro-electric development companies have had an increasing sale abroad. This has been due to their security and attractive rates of interest available; and it is reasonable to expect that a substantial portion of future financing in this industry will be absorbed in the Old Country."

* * * * *

"We . . . understand that there have been substantial blocks of securities of Canadian power enterprises placed on the London, Eng., market during recent years, and this capital has been welcome, particularly as it is of British origin. It seems that the bulk of the machinery and other equipment required by the Canadian power companies is being installed by Canadian manufacturers, but one authority whom we consulted states that the awarding of contracts is generally dependent on quality and price."

* * *

"Undoubtedly Canadian interests do want British capital in the development of our water powers, as, of course, in all other branches of industry but particularly those developing our extensive natural resources, and undoubtedly a good deal of capital for hydro development will find its way from Britain during the course of the next few years, for naturally the securities of these undertakings are offered in substantial blocks in the Mother Country. We feel, too, that there is splendid opportunity in Canada, and more especially in the hydro-electric power field, for the employment of much larger sums of British capital than even the steadily increasing amounts which have found their way into these undertakings in recent years. This capital, too, will be more than welcomed, for we would certainly like to see the proportion of British capital invested in the development of this country increased to the position it held some years before the war, that is, in relation to outside capital invested in the Dominion. Undoubtedly, too, the British electrical industry will benefit materially through Canada's expansion in the hydro-electric power field. As you know, the general feeling throughout the country seems to be that equipment will, where possible, be produced in Canada, but in the event of it being necessary to go outside of the country, certainly Canadians on the whole would prefer purchasing in Britain to any other country in the world. During recent years it has been said that the electrical industry in Britain had not been in a position to make deliveries as quickly as any of their competitors, nor have they been so aggressive in their sales or service methods."

The following is from the editor of an important Canadian financial paper :—

"British capital is decidedly welcome in connection with hydro-electric power development in Canada, and indeed has participated in practically all of the major developments of recent years. Most of the larger power developments have been financed simultaneously in Canada, United States, and Great Britain, with the latter country supplying, however, a small proportion of the total. This has been due chiefly to the prevalence of investment capital on this continent and to the fact that the Canadian and American bankers and investment houses have been more alert in maintaining contacts with those who are large borrowers. British capital is

welcome in power development in Canada, but must offer terms as attractive as American or Canadian capitalists are able to offer. Similarly, British equipment, when it meets the needs of the Canadian market, when price, quality, delivery, service, &c., meet the competition of American and Canadian firms, will find a ready enough market in Canada. Most of the generating equipment used in Canadian hydro-electric plants is manufactured here in Canada. The three largest producers of this type of equipment are controlled as follows:—Two in the United States and one in Canada. The one that is controlled in Canada was formerly affiliated with a British concern and still has substantial affiliations, but it . . . did not get any real co-operation from the Old Country. As you know, the Aluminium Company is controlled entirely in the United States, but it has placed a large contract for power transformers for its Arvida development with the Hackbridge Electric Construction Co., Ltd., of Walton-on-Thames, England."

The editor of another old-established Canadian financial paper states:—

"A good deal of the financing of some of the large private power corporations in this country has been done partly at home and partly in New York. On the other hand, I feel sure that Canadian interests would welcome British capital for future developments."

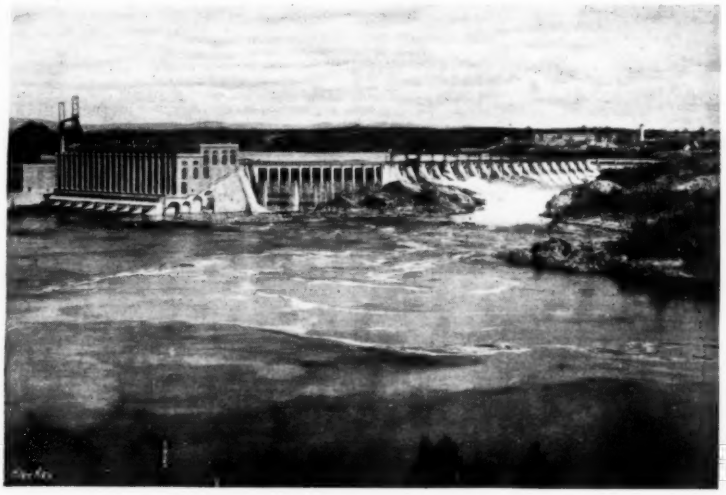
One of the outstanding financial men of Canada, in a personal letter to the writer, outlines the situation regarding hydro-electric finance in the following words:—

"Development of hydro-electric power in Canada results from decisions reached by Commissioners, acting on behalf of Provincial Governments, or by groups of private persons who see in such developments a profitable financial venture. When the development takes place under some one of the Commissioners acting for Provincial Governments, the financing is mostly done by the sale of securities guaranteed by the Government concerned. In carrying through such financing, firms of Canadian brokers are employed, and the securities are sold in Canada. When private interests are responsible for the development, it generally takes the form of an influential group already identified with hydro power schemes securing a franchise, and then setting up their financial structure after conference with bankers in Canada, or the United States, or both. The increasing amount of liquid capital available in Canada results in many of these issues being carried through with Canadian money. As to British capital: you are aware that for long years, when we were without cash resources to build railways, canals, water powers, and industrial plants, the needed money was commonly secured from England, by interested parties bringing their enterprises to the attention of British bankers, and if, on examination, they were believed to be satisfactory, British money came for the development. In this, British capital supplied for Canada the same service which in earlier years it gave to the United States, and later to South America, Africa, and other places where capital was required. During the war it was impossible for Great Britain to do any such financing. Following the war, by reason of adverse exchange rates and the expressed desire of the 'City' interpreting a national position, the export of British capital, while not prohibited, was curtailed. Meanwhile, the rapid accumulation of cash resources enabled Canada, without aid from the outside, to do much of her own financing. At times, however, both Canadian Government and Canadian private issues are financed in New York, and at odd intervals in London. I am sure that in so far as the sentiment of Governments or groups is concerned, there would be hearty support to British capital again coming to Canada when financing had to be done outside our own borders. If . . . there is a desire for bankers on your side to father investments in Canada on equal rates with money which can be secured elsewhere, undoubtedly preference would be given British money. Re-established contact rests with both communities; your people to intimate their desire to co-operate, and we to intimate our requirements. During the past week, after consultation with Canadian bankers, the Dominion Government negotiated a loan direct with bankers in New York, selling $100 million of 24-year 4 per cent. bonds on a basis slightly over 4¼ per cent. I would suggest, if bankers in England believe the time has come when they again desire to be active in financing projects in Canada, that they should get into communication with their correspondents here, when they could make it known that British capital is available at competitive rates."

A letter from a high official of one of the Departments of the Dominion Government states:—

"Owing to the unvarying success of hydro-electric undertakings in Canada, funds for their financing have been readily secured on favourable terms. During recent years you have probably noticed that such financing has usually taken place under the auspices of Canadian investment banking institutions, associated at times with United States and British financial houses."

One man who is fully conversant with the trade relations of Great Britain and Canada stated very definitely that in the case of British capital invested in Canadian hydro-electric undertakings care would have to be taken to spend as much money as possible in Canada and to give Canadian firms every chance; he pointed out also that, while the establishment of branch factories in Canada is being advocated in many quarters, this means that there will be greater competition and a further dividing up of work for an admittedly limited market. Like other authorities quoted herein, he remarked that this country is now well able to provide all the big equipment that she needs, even that of the very largest size.



By courtesy of the High Commissioner for Canada.]

The Grand Mère Development, St. Maurice River, Quebec.

The following details are based on data contained in a report supplied by the Dominion Bureau of Statistics, which covers the Canadian financial situation up to the commencement of 1929:—

The national wealth of Canada is estimated to be between 28,000 and 30,000 million dollars. Total British and United States investments amount to about 2,200 and 3,480 millions of dollars, respectively; other foreign investments are relatively insignificant. Canadian indebtedness to the United States rose in 1928 by about 165 millions of dollars, while that to Great Britain declined by nearly 17½ millions of dollars.

The table below gives interesting figures relating to foreign investments in Canadian public utilities other than railways, *viz.*: traction, light, heat, power, telephone, &c.:—

The figures are (approximate) millions of dollars. Apparently the dates refer to January 1st of each year named.

Country.	1926.	1927.	1928.	1929.
Great Britain ...	123	125	125	80
United States ...	183	268	301	327
Other countries ...	40	39	39	39
Total	346	432	466	446

The following is quoted verbatim from the report referred to above:—

"Against these amounts of indebtedness incurred by Canadians there must be set the sum of $253,000,000, which is the estimated amount of indebtedness discharged by means of refunding, serial payments, retirements, sinking funds, and repurchases of Canadian securities from abroad. It is estimated that $155,000,000 flowed back to the United States for these purposes, $96,000,000 to Great Britain, and $2,000,000 to other countries. In the case of Great Britain, more funds were sent back than came to Canada, hence our indebtedness to her was decreased by about $17,000,000 ($96,000,000—$79,000,000).* There continued to be considerable repurchase of municipal, provincial, and corporation bonds from Britain by Canadians, and changes in capital structure such as that of the B.C. Electric were also important influences."

* It will be observed from the table preceding that British investments in public utilities declined by about $46,000,000 in 1928.

In contrast with the foregoing is the statement on "Agricultural and Industrial Progress in Canada" published monthly by the Canadian Pacific Railway Company, a few extracts from which are given below. Addressing himself to American manufacturers, the author urges them—

"to familiarise themselves with industrial conditions in Canada in the lights of all facts—manufacturing costs, raw materials, markets, consumer interests and demand, methods of distribution, labour, tariff, &c., before proceeding to establish a branch plant or selling agency. That American manufacturers will take advantage of the wide opportunities in the Dominion is fully expected in Canada, and they will find every encouragement in the establishment of branch factories."

There is no doubt whatever that American manufacturers are on the alert at present, in view of the changed situation created by the new Government now in power at Ottawa, and its policy of higher tariffs. British manufacturers must be at least equally so if they are to find a place here. Indicative of the activity of American firms in respect of Canadian trade, it may be mentioned that the C.P.R. Co.'s publication just referred to gives a list of "Concerns in Canada associated or affiliated with concerns in the United States," which consists of the names of more than 1,100 firms covering a great variety of industries.*

In the *British Trade Journal and Export World* a letter, from an English correspondent familiar with Canada, appeared recently in which the following statement (with which the present writer heartily agrees) occurs:—

"The third and most vital essential is to arrange to keep stocks in Canada. No pro-British sentiment, nor even a considerable advantage in price, will attract a buyer who has to wait from the placing of an order for English goods anything from five to eight weeks, when he can get those same goods from the American manufacturer in from three to six days. . . . The ideal method would be to form a British trading or marketing company with capable direction, adequate organisation, and ample capital."

It is rather difficult to foresee what the new Canadian tariff will do for the British electrical manufacturer—the dictum of the Canadian Premier, the Hon. R. B. Bennett—"Canada first"—is apparently well taken care of in the recent tariff changes. Apparently he is better off in relation to competition with foreign countries, but rather worse off in respect of competition with Canadian firms.

Various authorities, according to published statements, prophesy that both British and American firms will give careful attention to the question of establishing branch factories here because of the increases in tariffs.

Canada's position of second in the world for export trade *per capita*, and of fifth in aggregate world trade, is very largely due to the utilisation of her great water powers, which has enabled her to develop mines, to use her forests for the production of paper—especially newsprint paper—and to erect large electro-chemical and electro-metallurgical works, as well as to provide factories which use more moderate amounts of power with all the power they need. For a country with a population of only 10 millions, the amount of money spent on electrical development and in the utilisation of electrical energy in Canada during the next 15 or 20 years will be not only relatively enormous, but also actually very large, running into many hundreds of millions of dollars—this is certain. Further, there is no doubt that United States' capital will play a considerable part in such work. Cannot British capital find itself an outlet in this country's electrical development†, and cannot British electrical manufacturers devise means whereby they will be able to take part in the future electrical trade of this great Dominion to an extent more comparable with the enormous share which the United States has already secured?‡

Does *not the way depend on the will*!

* Government statistics cover a total of 165 separate industries established in Canada.

† British capital is apparently available for the proposed development of a large amount of power at White Mud Falls on the Nelson River, 350 miles north of Winnipeg.

‡ See ELECTRICAL REVIEW, January 3rd, 1930, page 4.

"Management" Expenses.

Selected Station Owners and the Central Board.

By W. E. FODEN, A.S.A.A.

Financial Controller, Manchester Corporation Electricity Department.

A RELATIVELY minor, but none the less important, difficulty in the financial relationship of the Central Electricity Board and owners of selected stations which is now looming large under grid working, has been satisfactorily solved by the Board's foresight.

Under the second schedule of the Electricity (Supply) Act, 1926, the Board is, in the first instance, to pay the entire cost of generation at selected stations, such cost in the words of the Act including "the proper proportion of management and general establishment charges attributable to the station." Inherent in this is the conception, new to electricity undertakings, of dividing the entire range of expenses of generation, distribution, and sale of electricity into two parts:—

(*a*) Generation on the one hand with sale to the Board of all outputs at the stations, and on the other hand

(*b*) Re-purchase of part of outputs by the owners for distribution and sale to their own purchasers and consumers.

There is thus involved an arbitrary apportionment of those expenses which cannot be specifically identified because common to all activities. As noted, the Board is the purchaser of all outputs, takes delivery at the stations, and is only concerned with generation.

Arbitrary apportionment might justifiably be on different bases for different classes of owners: for example (1) a power company selling in bulk only; (2) a local authority selling partly in bulk and partly in retail; and (3) a local authority selling wholly in retail.

Prolonged investigation would have been necessary to determine a basis of apportionment and possibly friction between owners and the Board would have resulted. This will be self-evident when it is remembered that "management" expenses have a wide connotation and that their division, imaginatively as at the stations' switchboards and beyond, would have presented much difficulty, no matter whether division was by percentage of total or any other method. As an illustration of wide connotation it may be said that the following expenses would have needed arbitrary division:—

Management staff salaries, engineering and financial.

Rents, rates, lighting, upkeep, &c., of head offices which are frequently located away from the stations.

Personnel transport provided for staffs named and many other expenses.

Moreover, under the Electricity Commissioners' prescribed form of annual accounts for electricity undertakings, resting on subjective rather than on objective analysis, some latitude is permitted (or exists) in the present day allocation of "management" expenses so that some of them are treated in different ways by different owners. Lack of uniformity in accounting would have faced the Board at the outset. After examination and consultation with local authorities' and companies' representatives, the Board has cut the Gordian knot by fixing for all owners a definite annual sum per kilowatt of installed generating plant, the arrangement being designed for a ten years' trial.

"Management" expenses on generation account are in their nature dependent far more on plant installed than on user or output. The arrangement clearly rests on a logical footing and, so far as can be judged in advance, sacrifices no legitimate interests of Board or owners. Much financial work for all concerned is avoided by the arrangement, both in the preliminary stages of the grid working and in future tentative monthly and final yearly reckonings, for payment and audit under the intricate financial relationship arising under the Act.

Gamage's New Building.

Notes on the Electrical Features, with Particular Reference to the Lighting.

THERE is much of electrical interest at the new store at Marble Arch of Gamages' (West End), Ltd., which has a total floor area of 59,000 sq. feet. One of the principal features of the building is the artificial illumination, which is contrived on very elaborate lines. There are six entrances to the building, three in Oxford Street, two in Park Street, and one in North Row, as well as the goods receiving and dispatch docks. Each of these entrances is most attractively illuminated, the central main entrance in Oxford Street, fig. 1, and the Park Street corner entrance possessing illuminated canopies and illuminated columns and architraves, employing many hundreds of lamps. The lighting of the canopies is by means of 60-watt lamps spaced at approximately 12-inch centres, installed above diffusing-glass panels, and by lamps closely spaced around the extreme edges, these being installed behind etched drop panels. The main entrance canopy consists of a centre piece, with side wings merging into windows, which have semi-cylindrical moulded glassware columns of light forming illuminated architraves and contribute towards the general frontal illumination. The solidity and strength of the canopy installation render it one of the finest employing bent and jointed conduit work yet seen in a London store. The main Oxford Street entrance is illuminated on novel and effective lines. The moulded glassware architraves around the doors are very striking, while the concealed cove lighting simulates a pleasing gold and silver effect, and impresses by its simplicity. This is effected by means of 240 ft. of reflector and 30-watt "Striplite" lamps, and the lighting is augmented by a large main ceiling circular art-metal fitting, seven feet in diameter, fashioned of iron and finished in bronze colour. It is glazed with special amber-tinted glass, and equipped with "Pearl" lamps. The remaining Oxford Street entrances are lit on somewhat different lines by

Fig. 1.—Main Oxford Street Entrance by Night.

Fig. 2.—Excellent Example of Window Lighting.

16-in. diameter domed ceiling fittings, glazed opal with bronze-colour metal-work, and half spherical demi-coupe wall brackets, together with laylights of attractive design. The North Row entrance has two 9-ft. high

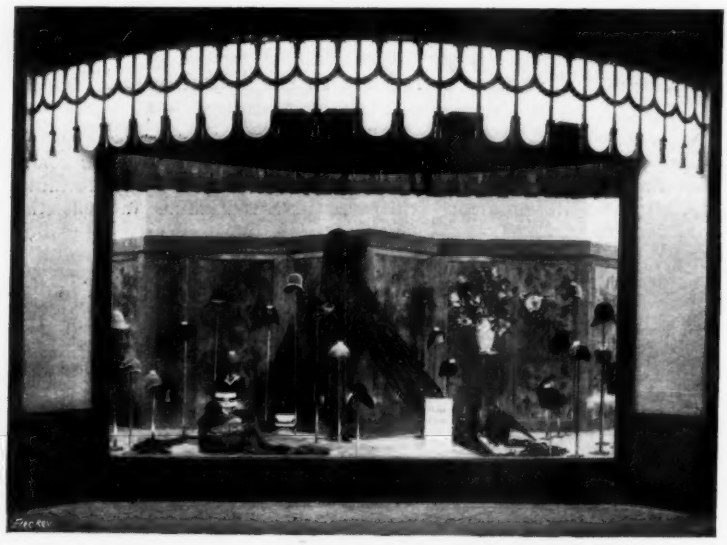


Fig. 3.—Canopy Lighting over a Corner Window.

"Gecoray" silvered-glass shop-window lighting reflectors and footlighting, aided by specially designed spotlights, figs. 2 to 5. There are upwards of 500 of these reflectors, and by the use of colour mediums a window-lighting display results which can only be described as a great and irresistible attraction to the shopping public of the West End.

The staircases of cream marble, with art-bronze metal furnishings, employ rectangular laylight type fittings suspended from the landing ceilings; this lighting is augmented by cove lighting and a number of moulded-glassware semi-cylindrical fittings. The side entrances have illuminated cornices, 444 ft. long, glazed opal and white, with 20-watt lamps at 6-in. centres, the metal-work being in bronze finish.

The various floors throughout the store are illuminated by well-designed types of lighting pendants employing high-wattage gasfilled lamps, the lighting being supplemented by that of the very large number of illuminated showcases, which are an outstanding feature of the store. In addition, there is a large number of pedestal counters, and these are illuminated very effectively from underneath by strip lighting to reveal

Figs. 4 and 5.—Two Well-illuminated Display Windows.

moulded glass illuminated architraves, three opal glazed oblong fittings close to the ceiling, and one circular art metal central ceiling fitting. The entrances at the corner of Park Street and North Row are illuminated along similar lines to the wing entrances in Oxford Street. Along the Oxford Street front there are twelve large display windows with illuminated moulded-glass architraves intersecting each window, accompanied by shallow recessed showcases let in flush with the Portland stone facia work. Along Park Street there are five large display windows, modelled on similar lines to those along the main frontages, as well as a number of smaller windows in North Row. The illumination of the whole of these windows is by

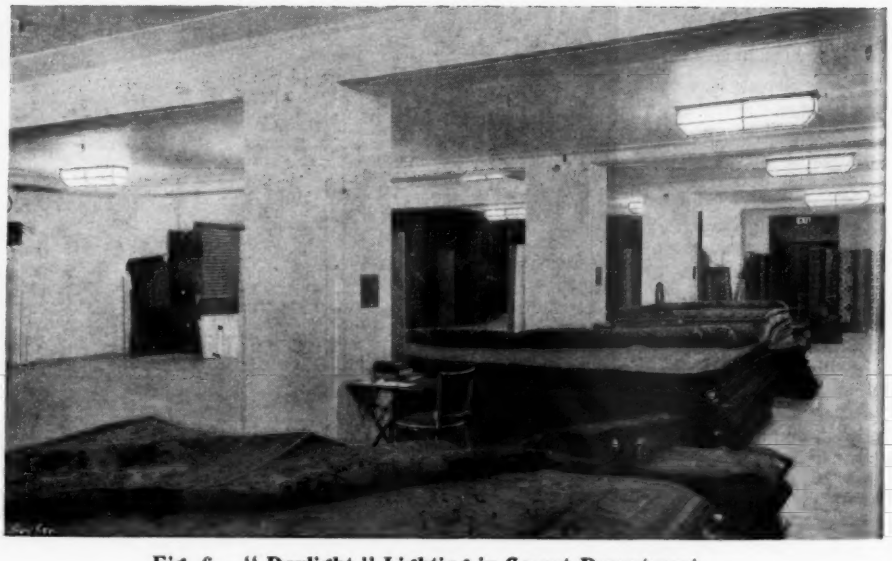


Fig. 6.—"Daylight" Lighting in Carpet Department.

the goods that are displayed "under the counter."

In the main basement the lighting consists of some fifty distinctively modelled surface-pattern boat-shaped

units, each equipped with four 100-watt gasfilled lamps. The art-metal work is real-bronze colour, and the glazing is flashed opal. There are also eighteen recessed fittings let into the ceiling alongside the passenger lifts, and others for general lighting purposes where the overhead clearance rendered it difficult to use surface-pattern lighting units. These fittings are lined with fluted stainless-steel reflectors, the lamps being fixed to removable back reflectors; the light source in each is four 100-watt gasfilled lamps.

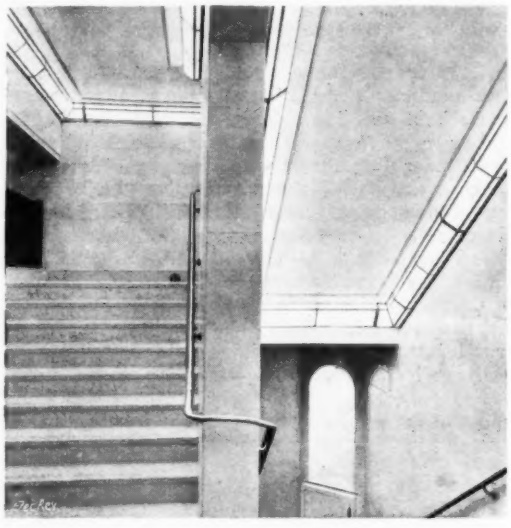


Fig. 7.—Cornice and Panel Lighting on Staircase.

Leaving the basement we arrive at the lower ground floor, which is entered from the street level by double staircases, the lighting of which is carried out in a very enterprising manner by means of illuminated cornice glazed in opal and white glass, fig. 7. On these staircases, too, there is a number of intriguing recessed panels, finished in silver colour, let into the walls; these are illuminated by semi-cylindrical moulded glassware single- and double-tier fittings, with bronze-colour art metal. In the carpet section, fig. 6, of this floor similar but larger-pattern boat-shaped fittings to those employed on the floor below are installed. These are wired on two circuits and equipped with four 100-watt clear and five 150-watt daylight-blue gasfilled lamps, which arrangement permits of the texture and colouring of the carpets to be inspected under conditions approximating to actual daylight. This lighting is augmented by a series of small rectangular fittings suspended from close to the ceiling.

The general lighting of the remainder of this floor is effected by some seventy special opalescent glazed pendants, with art metal in bronze colour and short four-point cream corded suspensions. These units are equipped with 300-W lamps.

(To be concluded.)

The Newest Electric Ships.

Four Up-to-date Electrically-propelled Vessels in Comparative Review.

By A. C. HARDY, B.Sc., A.M.I.Mar.E.

IT must be as flattering to the British electrical industry as it is disturbing to certain branches of the marine engineering industry, that within the short space of three months no less than four British designed and built electric ships of reasonably fast speed and for important duties left this country to take up their stations in service overseas.

It is only within the last three or four years, comparatively speaking, that the electrically-propelled ship has enjoyed any popularity at all in this country. Some of the earliest electrically-propelled vessels were built in England and went out to the Great Lakes of North America. That they proved dismal failures was not necessarily the fault of the electrical gear; it was probably due to the immaturity of the whole idea of electric propulsion, and to the fact that the marine world was not in a position either mentally or economically to accept the electric ship in any shape or form.

To-day things are different; while it is impossible to deny that the electric-ship idea is one which, if it has not entirely filtered across the Atlantic from America, has to a great extent been developed by American ideas and American capital, this type of vessel has now developed to a point in British shipping at which it can be stated definitely to have taken its place very worthily alongside other forms of marine propulsion. Indeed, it does not seem too much to suggest that, so far as marine steam technique is concerned, it may very largely have to look to electricity to help it to regain some of the distance which it has already lost in the race for supremacy with the Diesel oil engine, and it is further handicapped perhaps by the fact that the Diesel engine itself is capable of combination with electricity generators to provide propelling arrangements which are by no means undeserving of attention.

It is this fact which places to a certain extent the electrical companies which are at the back of this marine-propelling business in rather an awkward position, because, while in certain ship-owning circles they have some difficulty in convincing technical advisers as to the advantages of electric propulsion, the economics of such ships being very involved and difficult of clear exposition, they have the added difficulty of asking the owner to choose between driving the generators (which will eventually supply energy to the propelling motors) by Diesel oil engines or by steam turbines. There is too the further difficulty in the way of really unbiased advice that, should the electrical companies advise the use of Diesel engines, they will only be giving themselves part of the total machinery contract, whereas should they advise the adoption of turbo-alternators, they will be giving themselves the whole of the machinery contract, and because the whole will, in the latter case, be capable of execution in one designing office, as it were, they will probably feel that they can offer a much more satisfactory job to their client. The statement that if turbo-alternators are chosen they will be responsible for the whole of the machinery contract is not in effect correct, because they must sub-contract their boiler plant; but, even so, unless the owner or the shipbuilder declares any special preference, they will probably favour one type of boiler, and that particular manufacturer of boilers who has co-operated with them in their land power-station work. Such being the case, we can readily see how true is the expression of opinion voiced at the beginning of this article, namely, that the

addition of three turbo-electric and one Diesel-electric ships to the world's mercantile marine from British shipyards in the last few months must have been viewed not altogether with complete satisfaction by the British marine engineering industry. For the British marine engineering industry is now apt to find itself in a position that is definitely subsidiary to the marine electrical industry. This is a juxtaposition of affairs which held some 20 years ago when the electrical industry was called upon, not altogether in every case willingly, by the marine engineering industry to supply one generator set, to wire a ship for electric lighting, or to supply a certain amount of radio equipment. To-day, the marine electrical industry may call upon the marine engineering industry to supply four boilers and perhaps a dozen pumps as its contribution to the equipment of a ship, which is an indication of how things change; and the fact that the tendency on modern turbo-electric ships is to reduce the number of boilers may even more circumscribe the activities of the marine engineering industry, for, in addition, it puts the construction of such boilers in the hands of a relatively small number of people.

High steam pressure and high superheat are the order of the day when marine turbo-electric propulsion is concerned. It is not an ordinary boiler maker's job—it is a job for boilermaker-cum-metallurgist. Turbo-electric propulsion, then, is going ahead without any real encouragement on the part of shipbuilders or marine engineers. It is going ahead because the shipowner likes it, and because he senses that it is the propulsive method of the future for a great number of ship types. It may bring back steam into its own, but it will not do so through the original channels of flow. It will do nothing to restore the flagging British coal industry to its original state of prosperity. It is essentially of the new era, and will therefore have problems all its own. What those problems are we are only now beginning to understand, and the recent trials of some of the ships, whose characteristics it is the purpose of this article briefly to discuss, have already revealed a number of points whose existence was only very generally suspected before the ships were completed.

It has been stated that three of the vessels were turbo-electric ships and one was a Diesel-electric ship. It is not the purpose of this article to differentiate between the respective progresses of the two systems, but it may be submitted with some degree of correctness that for ships other than tankers, tugs, and ferry boats, the tendency is, of course, towards turbo-electricity rather than Diesel-electricity for propulsion. The Diesel-electric tankers which have been built are confined principally to one company. The Diesel-electric ship of the group of four we are discussing now is a cement carrier** for special service on the Great Lakes, where space would rule out what economics might otherwise dictate and make necessary the inclusion of Diesel engines to drive the generators. The three ships we have under consideration then are fruit-carrying vessels, which are ships with insulated holds somewhat like meat carriers, except that fruit, *i.e.*, bananas in this case, is, if anything, a more "temperamental" cargo than meat. The banana is the only fruit which requires special ships to carry it, the carriage of which has developed into an industry alongside which a very lucrative tourist industry has grown. Ships which carry bananas are all specialised ships, and have high auxiliary loads, because they require electric power to drive their refrigeration compressors. Many people would argue, and argue correctly, that such power would be best obtained tapped off the main supply source, and that therefore Diesel-electric propulsion would be the better. The particular firm in question which owns these three ships has had some unfortunate experience with Diesel-electric propulsion, which may be judged by the fact that the first ship we shall mention, the *Darien*, was originally completed in 1924 for electric propulsion, but came this year to Belfast to be converted from Diesel-electric to steam turbo-electric propulsion of the most recent type. This involved, it may be interesting to note, the lengthening of the vessel some 30 ft. to accommodate the boilers, even when very high-pressure, high-superheat, water-tube boilers were used, and only two of them were required to give over 3,500 horse-power to the shaft; but the fact that the ship had to be lengthened naturally increased the power required to drive her at the same speed. The problem was to lengthen the ship without decreasing her fruit-carrying capacity and her speed. Actually the latter has been very slightly increased, but her block coefficient has been increased and her necessary shaft-horse-power has increased accordingly.

The next vessel, the *Musa*, one of two vessels, the sister ship being called *Platano*, was completed by Messrs. Workman Clark, of Belfast, in July as an

RECENT BRITISH-BUILT ELECTRIC SHIPS COMPARED.

Characteristics—	*Darien*	*La Marea**	*Musa* and *Platano*	*Cementkarrier*
Ship				
Owner	United Fruit Co.	United Fruit Co.	United Fruit Co.	Canada Cement Transport Co.
Duty	Banana carrying	Banana carrying	Banana carrying	Bulk cement transport
Tonnage	3,300 d.w.	3,300 d.w.	5,500 d.w.	3,150 d.w.
Draught (load)	22 ft. 3 in.	23 ft. 8½ in.	25 ft. 6 in.	14 ft.
Speed (loaded)	14½ knots	14 knots	16 knots	10 knots
Dimensions	352.5 × 48 × 31.7 ft.	325 × 48 × 31.7 ft.	415 × 56 × 34 ft.	258 × 43.2 × 20 ft.
Boilers	Water-tube	Diesel-electric four 500-kW direct-coupled Diesel generators	Scotch.	Diesel-electric two 500-H.P. gens. direct-coupled auxiliary load as big as main propelling load
Number of boilers	2		5	
Pressure	370 lb.		250 lb.	
Superheat	264° F.		200° F.	
Turbo-alternator	One 2,700 kW 1,200 v. 3-phase 9-stage turbine		One 5,500 kW 2,600 v.	
Motor	Single armature	Double armature	Single armature	Single armature
Power (rated)	3,300	2,500	6,750—7,000	775
R.P.M. (rated)	125	95	120	100 approx.
Block coefficient	0.617	0.586	0.60	0.8 approx.
Make of machinery	B.T.-H.	B.T.-H.	B.T.-H. (*Musa* only)	G.E.C. (Witton)
Performance—				
Mean speed on mile	15.775	14.36	18.31	9.2
Power at shaft	3,640	—	7,188	—
Revolutions of propeller	131.25	—	124.4	100
Output of main generator	2,830 kW	—	5,625 kW	320 kW
Output of auxiliary generator	284 kW	—	130 kW	31.9 kW
No. of auxiliary generators running	1 at 500 kW	—	1 at 130 kW.	2
Boiler pressure	385 lb.	—	270 lb	—
Steam temperature	255° F. superheat	—	590° F.	—
Displacement	4,840 tons	—	7,000 tons† approx.	—
Draught	16 ft. 3 in.	15 ft. 5½ in.	18 ft. approx.	14 ft.

*La *Marea* was *Darien* before conversion.

† Load displacement is 10,620 tons on 25 ft. 8¾ in.

** See ELEC. REV. October 10th, 1930.

entirely new vessel. It is surprising to record that, while water-tube boilers were used on the reconstructed vessel *Darien*, they were not used on the *Musa*; while the *Darien* requires only two boilers for over 3,500 shaft-horse-power, the *Musa* requires five for 7,000 s.h.p. The latter boilers are of the Scotch type, and do not present anything unusual in the way of design, except that, of course, they have superheat. Whatever the experience of power station engineers may have been with superheat, it is idle to deny that some trouble has been experienced with superheaters on marine boilers, but it is just as futile to admit that such trouble and the difficulties of maintenance which they entail are insuperable. Naturally many shipowners feel that they themselves should not be the people to carry out the necessary practical experiments to overcome the trouble, but it is very definite that unless progress is made with water-tube boilers on board ship, turbo-electric drive will suffer a grave set-back. The alternators and propelling motors themselves are very reasonable in the space they take up, but if with them one finds large Scotch boilers, then all the space advantages are negatived.

Compactness is the key note to marine machinery. Electricity provides that compactness, together with a very desirable flexibility of operation, provided that the generating plant which accompanies it shares its part of the burden. The table on the previous page contains detailed particulars of these recent electric ships, and shows how successful they were in operation on their trial trips.

Slot Meter Custom.

An Attempt to Resolve the Two-part Tariff into a Flat Rate.

By "INVICTUS."

VENDORS of distributed gas long ago went in for the cultivation of output by putting an attractive proposition before the small consumer through the medium of penny slot meters. I know an old cabby owning an ancient four-wheeler who for years has had a regular customer in the local gas company for the daily conveyance of meter collections to the bank. It is good business. Catering for large numbers of small customers always is good business.

In electricity supply also the slot meter business is extensive for lighting purposes. Much astuteness has been practised to overcome the difficulties of electricity tariffs in connection with slot meters. There are, no doubt, many admirable methods in use (as well as some "half-baked" efforts) which are intended to apply two-part tariffs to slot meter consumers, but the fact remains that the problem of how to deal with small slot-meter custom in a practical and simple way is one which is troubling many able and enterprising supply men.

Is not the solution of all the maze of tariff theories simpler than it has been made to seem? Pet tariffs are almost sacrosanct to their propounders, like a religious cult. Who dares to question does not understand, and has not seen quite so far and so clearly as the man who thinks he is taking the responsibility. But there is no responsibility as a matter of fact, because no one has been bold enough so far to offer a tariff for general supplies which does not ensure a very comfortable margin in case, as would be ridiculous, the tariff should be "unsound." All our theory is, of course, excellent. But is it not time we sunk our individual cleverness with two-part wangles and put a simple proposition before a willing and impatient buying public? The tailor does not confuse a man with a two-part tariff when he wants to sell a suit of clothes. Yet the tailor's shop is just as truly tied to the two-part principle as electricity supply, or any other business.

Surely nothing will matter in the future but flat rates. All the ungainly and differing rates which are under experiment to-day are leading with a slow and wearisome evolution to nothing but flat rates. If these are to be measured with maximum demand indicators they can be called kilowatt-years, and, if by ordinary integrating wattmeters, then let us offer the public nothing but simple kilowatt hours. That is what the public want, and that is what would square with the popular "penny a unit" talk, the publicity value of which the supply industry has so far, for the most part, ridiculed or disowned, whilst all the time doing it and keeping it hidden under a tariff cloud.

The solution to the slot-meter difficulty must be flat rates. The only other essential factor is an ability to treat the public as honest in the main, instead of allowing an occasional case of shop-lifting to shut the store.

The Small House.

The business in mind at present is the small house where the annual consumption for lighting purposes amounts to only about 80 kWh. In an oldish undertaking the rate may be 6d. or less, in which case the lighting consumption may reach a rather higher average number of kWh. In a newish undertaking the rate may, quite justifiably, be well over 6d. For purposes of example we will take upper instead of lower figures and assume an average annual consumption of 80 kWh at 9d., and bulk supply costing 1½d. per kWh in relation to this class of customer.

The supply authority is therefore content, but perhaps not well content, with an average revenue of £3 per annum from such supplies. This is made up as follows:—

80 kWh at 9d.	720d.
Less bulk cost at 1½d.	120d.
Balance to meet all other charges ...	600d.

This consumer probably would appreciate the use of an iron. Households of the description do a great amount of ironing; they would certainly have no difficulty in using 50 kWh a year for this purpose, but 3d. or 4d. an hour for this service cannot possibly be considered an economic or justifiable rate for a *pro bono publico* supply authority to accept. Let us sell them an iron and the service they need upon the following terms:—

All other charges as before	600d.
130 (80+50) kWh at 1½d.	195d.
Two years' purchase of iron	60d.
	855d.

Thus 130 kWh for 855d. is approximately equal to 6½d. per kWh, and this is the rate for which this consumer's slot meter should be adjusted until the iron is paid for.

Effect of the Small Cooker.

But having introduced to this class of consumer the wider use of electricity, why should he or she not be offered still further facilities upon the same equitable principle? A handsome and efficient little cooker can be

installed and hired for 5s. per quarter, and any properly run undertaking is now supplying, or is about to supply, at a profit, electricity at 1d. per kWh for cooking purposes. Here is the case :—

All other charges as before	855d.
Cooker installation and hire	240d.
800 (cooking) kWh at 1d.	800d.
	1,895d.

930 kWh for 1,895d. is equal to approximately 2d. per kWh, which is the rate for which the slot meter should be set.

If, as may be the case in a small minority, the consumption does not come up to reasonable expectations, either the consumer can pay up the computed difference, if he is minded to do so, or the supply people will exercise their right to remove the cooker, reset the meter mechanism, and return to the *status quo*—the next higher appropriate flat rate.

Persuing the same principle, but without hurrying the consumer, the time may come when radiators and other appliances will interest him. The 2d. rate will not be prohibitive as it stands under the last example for a little occasional heating; half an hour in the bedroom upon retiring, for instance, or the kettle for early morning tea.

Electrical Water-heating.

But the whole principle can be brought down to immediate practical all-electric service by the installation (at the customer's desire, and certainly not as a victim of express sales methods) of complete or auxiliary thermostatically-controlled domestic water heating. With this we have :—

All other charges as before	1,895d.
Water heating installation and hire	240d.
2,000 units at ½d.	1,000d.
	3,135d.

2,930 kWh for 3,135d. is nearly equal to 1d. per kWh, at which rate the slot meter can confidently be set with the assurance that profitable business and a square deal is being offered.

With such a scheme in general operation it would not be long before the collector could leave behind him a rebate from the takings large enough to enable little Georgie to have a new pair of boots. The B.B.C. programme on the all-mains wireless would be good that night, and everyone would say " God bless Electricity."

So far as the consumer is concerned, none of the foregoing detail need be understood, or even suspected. The only point with which he is concerned is that he has electricity with a penny slot meter. Price per kWh need not, and indeed, should not, appear in the transaction. So many hours for a penny for any different service is all that matters to the consumer.

The meter department will alter the slot-meter change-rate mechanism as the sales department advises, and in any town of 20,000 inhabitants the four-wheeler will soon be required upon most week-days. The bulk of business will justify the organisation which is at present, in many cases, so dreaded.

Irish Water Power.

The Irish Free State Electricity Supply Board claims to have solved the River Shannon hydro-electric power problem; some of its achievements to date.

By R. N. TWEEDY.

THE citizens of the Irish Free State are awaiting without much anxiety, or interest, the report of the I.F.S. Electricity Supply Board for the financial year ended March 31st, 1930, because it will be concerned only with a period of construction, such as was covered by the previous report, and everybody was able to see for himself during those periods that the Board was not wasting its time. Whether it was wasting the money of the citizens in a feverish attempt to justify the egregious folly of a junta of revolutionary enthusiasts, mostly too young, or too ignorant, to be in control of national affairs, could not be discovered until the publication of a report covering the first full year's trading, although it might be believed with the fervency of which only the intellectual invalid is capable.

If the interest of the citizens in the overdue 1929-30 report was no more than tepid, it must have become stone-cold since Mr. T. A. McLaughlin's talk to the Dublin Rotary Club on December 15th, when he anticipated the report for 1930-31, which we may expect to see in print early in 1932, in the usual belated course of such things.

The Dublin Rotary Club was a good platform for the message which the managing director of the I.F.S. Electricity Supply Board conveyed to the citizens, for it is in itself a fairly representative cross-section of Dublin society, with the exception of the upper and lower strata of the idle rich and the wage earners. Tests of opinion within the Club upon the merits and, later, upon the prospects of the Shannon hydro-electric power scheme would have given at any time reactions similar to those to tests made at random outside the Club, and just as divergent. We (I write as one of the earliest members of this, the first Rotary Club in Europe) were swayed to one side or to the other, more or less, as our inclinations, politics, prejudices, or mere knowledge affected our judgement. Probably the general average opinion all along has been coloured more by hope than by faith, and, latterly, by glowing pride in the knowledge that one of the great engineering works of the world actually has reached the completion of its first stage in this little island.

Mr. McLaughlin's talk was keyed to a note of triumph, and undoubtedly was directly antiphonal to the dirges in minor keys to which he and his colleagues have had to listen for some years. Both the lay and the technical Press on the British side of the Irish Sea had been rather gratuitously hostile to the scheme in its earlier stages; and it is necessary only to quote a few sentences from a paper on " Electricity Supply Development," read in 1925, to see how even eminent engineers like Mr. Johnstone Wright, then city electrical engineer of Belfast, became infected by whatever anti-Free State bug was going at that time to a degree which led them to prophesy without knowing :—

" Since writing this paper the documents in connection with the Shannon scheme have been published. . . they are interesting documents, but, in my opinion, extremely optimistic.

"The proposal is to launch out on a scheme, the partial development of which is estimated to cost £5,200,000, and the full development £7,200,000. The first section of the scheme will be designed to produce 153,000,000 kWh per annum, and on this the price for current is based. Before the scheme can pay the interest on the capital the consumption for the whole of the Free State must be increased threefold. In my paper I gave the consumption in the Free State as 47,479,900 kWh per annum, and this agrees fairly well with the figures given in the documents.

"I am optimistic about development in Belfast and Northern Ireland, but one would have to be a super-optimist to suggest launching out on a scheme, the first instalment of which would cost £5,200,000, and yet there is undoubtedly a greater field for electricity supply in Ulster than there is in the Free State. The capital cost of the plant to be installed at the power station alone for the partial development is estimated at £54 per kW, and for the full development £41 per kW of plant installed, both of which are excessively high figures as compared with steam stations, so that while the source of power may be cheap the capital costs to harness it are high. . . . If the proceeds only fall short by the annual amount of the capital charges the Shannon scheme will do better than one would anticipate, but if nine or ten years have to elapse before it can pay all the running costs, even exclusive of capital charges, what then? . . . Having had some experience in the operation of a very large network I could not accept the working costs given in the report. . . . There seems to me to be little hope of a scheme of this magnitude being a financial success unless there is a very great industrial development in the South of Ireland, where at present the power demand is very small indeed. . . ."

Now let us refresh our memories on one or two matters in the experts' report upon which the Free State Government acted.

In the introduction they made the most intensely illuminating summary of the position as they saw it:—

"The Free State finds itself to-day in a favourable position in relation to the electrification problem. It has before it a new development, substantially simplified in the absence of numerous unsuitable existing power stations, and it has the advantage of having the wide experience acquired by other countries at its disposal. The rational electrification of the country under these circumstances with mutual goodwill on all sides, should easily be carried through. The extraordinary high prices, at present existing for electricity in the Free State, which have a prohibitive tendency as far as development is concerned, indicate that a radical change must take place in the electrical supply of the country if the population are to have the advantage which the use of electricity . . . in the household, factory, and farm, brings with it."

There was at the time of the report a total installed capacity in the public electricity works, including those of the Dublin tramways, of 33,000 kW, giving an annual production of about 55 million kWh. In the three cities of Dublin, Cork, and Limerick the production was equivalent to about 50 kWh per head of the population per annum.

Not less than 2,400,000 of the population have supplies of electricity at their disposal; calculating on a cautious basis, the experts estimated the demand for all purposes from the three cities on the partial development of 115 kWh per head per annum.

In a few years after the opening up of large-scale electrification an output of from 45,000 to 50,000 kW at the generator terminals would be necessary; accordingly an installation of 63,000 kW has been provided for the first stage, which represents for a population of 3,000,000 an output corresponding very closely to the average world output.

For thirteeen middle-sized towns, having a total population of 180,000, the *per capita* consumption was estimated at 55 kWh; and for 78 small towns with an aggregate population of 143,500 the figure taken was 30 kWh. In the rural areas the experts assumed that progress would be slow, and the estimate of consumption is too involved to be quoted here. Probably it was more cautious than the others.

The assumed maximum load in the partial development is 48,000 kW, and 153,000,000 kWh can be delivered from the partial development in a dry year, yielding 110,000,000 kWh at the consumers' meters.

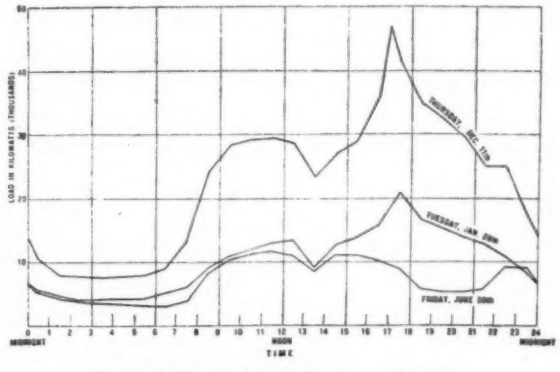
The experts divide their economic periods into two load stages, the first load stage corresponding to the power demand two or three years after the start, and the second load stage corresponding to a period of five to ten years after the start. They calculate the income of the undertaking at £405,000 per annum in the first load stage, when a loss of £81,000 would be made; and £762,000 in the second load stage, for which a gain of £91,000 is calculated, the return on capital being, respectively, about 4 and 6.8 per cent. The net result of the experts' inquiry into the economy of the scheme is that in about five years the development should return about 5½ per cent. on the invested capital, with a gradual increase up to 7 per cent. or more.

The average cost of energy at the works is worked out for about 150 million kWh at 0.41d.

Everything was done according to plan, and 14 months ago the trained fall at Ardnacrusha started its career of usefulness, with a lamentable absence of ceremony. On December 15th, 1930, the young man to whose educated vision, persuasive pertinacity, and love of his work the Irish Free State owes the national electricity undertaking told us in twenty minutes, so far as he could, how the ascertained facts agreed or disagreed with the estimates.

During the past year the three principal cities, Dublin, Cork, and Limerick, together with the townships extending Dublin proper and 24 country towns, all of which had been supplied with electricity by some station burning imported fuel, were changed over to the Shannon supply. Work is proceeding in 18 other towns preliminary to a similar change taking place.

Very considerable new work had to be carried out, particularly in the cities, before the change could be made, and in one case much delay was occasioned by the negotiations between the Board and the Company in possession. Similarly, much revenue has been lost to the Board by the long-drawn out negotiations between the Board and the Dublin Tramways Company, that load, yielding about 19 million kWh yearly, having been transferred only a few weeks ago. Messrs. Ford's tractor works in Cork, where 6,000 kW of mercury-arc rectifiers is installed, have been working at a fraction of their output ever since they changed over.



Typical Daily Load Curves, 1929-30.

It cannot be said, therefore, that the Board's luck has been outstandingly good, so that Mr. McLaughlin would have been justified if he had chosen to attribute the attainment of his objective almost entirely to new demand brought into existence by the national scheme, and owing little to the old stagers.

Perhaps the most intriguing facts derived from Mr. McLaughlin's speech is that the area under electricity supply in Dublin City and suburbs has been increased in the past year by 75 per cent., while the area under supply in Cork City and suburbs is being increased at present by 50 per cent.

Sacred boundaries and all the other restrictive things inherent in the system still troubling you in Great Britain, but never more to harass us, had prevented these extensions until the Act of 1927 created a Board with a broom strong enough to sweep all such lumber into the sea.

New networks have been completed in 88 towns and villages scattered all over the country, and there remains scarcely a village of over 500 inhabitants which is lacking an electricity supply.

(To be continued.)

Reviews.

The Elementary Principles of Wireless Telegraphy and Telephony. By R. D. BANGAY. Third edition revised by O. F. Brown, M.A., B.Sc. (Oxon). Pp. xii+268; figs. 299. London: "The Wireless World." Iliffe & Sons, Ltd. Price 10s. 6d. net.

Mr. Bangay was one of the first to attempt to describe the principles of wireless signalling in a way which could be understood by readers with little or no knowledge of electricity or magnetism, and with only an elementary knowledge of mathematics. The attempt was so successful that his book was recognised for many years as one of the best elementary text-books on wireless telegraphy and telephony published in this country. It is now, however, several years since the second edition appeared, and it was apparent that even elementary principles, due to the development of valve work ing, had broadened out to such an extent that the book no longer fulfilled its role of a standard text-book.

In this third edition, Mr. Brown has retained the principles as described by Mr. Bangay, until the thermionic valve appeared on the field. He has rearranged Mr. Bangay's portion and has omitted a good deal of matter on spark and arc circuits, and obsolete forms of receivers, such as magnetic and electrolytic detectors. But in other respects he has kept closely to Mr. Bangay's text, so that the latter's simple methods of explanation have been retained; this is a distinct advantage, as the success of the earlier editions was primarily due to simplicity in explanation. This new edition is very naturally larger than the former ones, as nearly half of it is devoted to valve developments, instead of little more than one-tenth as in the previous edition.

This half, which deals with the latest developments, has been written by Mr. Brown clearly and very concisely, and as he holds the post of secretary of the Radio Research Board he is particularly well placed for dealing with the most up-to-date improvements. He never forgets the first sentence of his introduction, *viz.*, "The object of this book is to instruct the reader in the principles underlying the construction of modern wireless telegraphy apparatus," and in telegraphy he includes, from his knowledge of its legal interpretation, telephony. In Mr. Bangay's book, wireless was always wireless, and Mr. Brown retains that wording in the first half, but in his own half he continually drops into the more modern "radio." It would make pleasanter reading to have the one or the other throughout.

The production of the book is first class, and it covers accurately the whole ground of the elementary principles underlying the latest developments, but purposely avoids dealing with principles which only lead up to apparatus now obsolete. Mr. Brown rightly recommends that the reader should have an elementary knowledge of electricity and magnetism, but these subjects are so well summarised in the earlier chapters that any student, provided he has a good knowledge of elementary methematics, should be able to understand the book; we have no doubt that it will occupy the same place in the front rank of elementary text-books as was held by the former editions some years ago.

Handbook of Technical Instruction for Wireless Telegraphists. By H. M. DOWSETT, M.I.E.E., F.Inst.P., M.Inst.R.E. Fourth edition; revised and enlarged. Pp. xix +487; figs. 459. London: "The Wireless World." Iliffe and Sons, Ltd. Price 25s. net.

This book, originally written by Mr. J. C. Hawkhead, has been a standard textbook for marine wireless operators in this country for the last seventeen years, Mr. Dowsett, the present author, having been responsible for the second and third editions. The third edition was published in 1923, and it was high time for a new edition in view of the rapid developments which have taken place in marine wireless telegraphy during the last few years.

The author's aim is "to provide simple instruction for sea-going operators and others in the general principles and practice of wireless telegraphy, illustrated by marine apparatus developed by the wireless companies of Great Britain." His book therefore covers ground which is not covered by any other book, and so far as this aim of the author is concerned, covers it well. One-third of the book is devoted to electricity and magnetism, and two-thirds to wireless-telegraphy with special reference to the marine service. Space is found for descriptions of the apparatus of the three companies which supply wireless installations for our mercantile marine, including the latest developments in direction-finding sets and auto-alarm apparatus. The chapters on c.w. and i.c.w. sets, d.f. sets, emergency sets, and auto-alarms are good, and if the book had contained equally up-to-date information on telephony, its value as a textbook for wireless operators would have been considerably enhanced.

The author claims, too, that the book "provides a complete theoretical course for the Postmaster-General's Certificate," but in this respect we consider that it does not completely fulfil all that is required. Telephony, for instance, is not dealt with fully enough for the requirements of the first-class certificate and the diagrams of the q.q. spark sets are over simplified for examination purposes as they do not contain all the apparatus in the circuits. The mathematics, on the other hand, is occasionally above the standard expected. On at least one occasion the author goes so far as to drop into calculus notation, which is quite beyond the sort of knowledge expected from candidates for the Postmaster-General's Certificates. The space available in a book of this size, considering what is essential for the wireless portion, cannot, we think, cover adequately the preliminary subjects of electricity and magnetism, and in this respect, too, we consider that the book falls short of the author's claim to a complete theoretical course

The book is well produced, with clear diagrams and a good index. It is the best single book that can be recommended for the use of students studying for the Postmaster-General's Certificates—but it could be better.

The Magneto Manual. A Practical and General Reference Work for Automobile Engineers, Aeronautical Engineers, Mechanics, Apprentices, Car-owners, &c. By H. R. LANGMAN. Second edition. Pp. xii+246; figs. 90. London: Crosby Lockwood & Son. Price 7s. 6d. net.

The fact that a second edition of Mr. Langman's work on magnetos has been found necessary is an indication that his treatment of the subject is one that has appealed to a wide circle of readers, and particularly to the engineers and mechanics employed in connection with the automobile and aeroplane industries. The purpose of the book is not to describe the construction of any particular magneto, but rather to consider the outstanding features of the best types in every-day use, which the author does very thoroughly in a series of twelve chapters. Generally speaking, the new edition is unchanged in its main contents, the principal new feature being an additional chapter in which an attempt is made to explain the functioning of h.t. magnetos by a scheme used with success for many years by the author. It also embodies a series of hints on the maintenance of ignition devices, illustrated by sketches depicting certain faults which may arise, a particularly useful one for motorists and motor repairers being the illustration showing the parts of a magneto distributor which may fail to work correctly owing to worn, broken, or dirty parts. The book concludes with a series of sixty questions by means of which the reader can ascertain whether he has assimilated all the instruction offered him by the author, and, if he still needs enlightenment on any particular point, he can quickly turn to the necessary page by reference to the index.

Although Mr. Langman has treated his subject exhaustively, one feels, without any idea of discouraging him, that, whatever may be the case in the world of aviation, there is likely to be a diminishing demand for his book on the part of motor vehicle users and engineers for, as doubtless he is well aware, there is a distinct tendency for motor manufacturers to discard the magneto for coil and battery ignition. Three years ago (1927) it was estimated that about 72 per cent. of all cars had magneto ignition as against only 22 per cent. with coil and battery—the remainder being mostly a combination of both—whereas this year the proportion of cars with magnetos has fallen to 30 per cent., while that with coil and battery has gone up to 60 per cent. Although the reviewer is one of those who prefers the magneto which, given such attention as the author recommends, he has found extremely reliable, he believes that the cars of the future will include few with magnetos. This short review is not the place in which to dilate at length as to the reasons why coil and battery ignition has so quickly leapt into popularity; one can only accept facts as they are, and, writing as a motorist, take it that car manufacturers would not so equip their vehicles were they not convinced that the various components will give satisfactory results in practice. At the same time, there is still a sufficient number of cars on the road with magneto ignition that should render it not a waste of time for either motor users or repairers to make a careful study of the information afforded by "The Magneto Manual."

The Talkies. By JOHN SCOTLAND. Foreword by CECIL M. HEPWORTH. Pp. xv+193; illustrations 36. London: Crosby, Lockwood & Son. Price 7s. 6d. net.

The writer of this book we may suspect is one who has chosen to hide his light under a bushel; anyhow, although the name John Scotland is new and unfamiliar to us all, it is clear that the author is at least an old hand in the kinematograph world.

No one with the least scientific imagination can fail to be interested in such a vital industry as the talkies from whatever point of view it is presented, and John Scotland has chosen to present it from a popular angle. The author states at the commencement that he does not intend to employ a single mathematical formula, and, although it is evident that there are several occasions in the book where he is dying to interpret things in the form of symbols, he faithfully sticks to his promise and carries through to the end in the kind of language that we can all appreciate.

The scientist must not be prejudiced against this book on this account, because it is the work of a very practical man, and such knowledge, drawn from a wealth of experience, is not to be despised by any man. Neither should the layman who is desirous of taking his first steps into the realms of science be afraid, because there is nothing formidable. In other words, we have, one and all, to thank the author for giving us the benefit of his experience in a very palatable form.

C.M.R.B.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Compliments of the Season.

We desire to express our thanks to all those readers who have sent their greetings to us during the Christmas season, and to assure them that their kind wishes are heartily reciprocated.

The " Electrical Review " Index.

The Index to Vol. CVII (for the half-year ended December 31st, 1930) is in course of preparation and will be published shortly. We shall be glad to receive the names and addresses of those who require it (free of charge), for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

Central Electricity Board Contracts.

The Central Electricity Board has just placed additional contracts (including extensions to certain contracts already announced) to the value of approximately £2,000,000. The contracts relate to various schemes adopted by the Board for different parts of the country, as follows: South-West England and South Wales Scheme.—Overhead transmission lines: Callender's Cable & Construction Co., Ltd.; and W. T. Henley's Telegraph Works Co., Ltd. East England Scheme.—Switchgear: Metropolitan-Vickers Electrical Co., Ltd. Mid-East England Scheme.—General meters and transformers: Metropolitan-Vickers Electrical Co., Ltd. North-West England Scheme.—Switchgear: General Electric Co., Ltd.; and A. Reyrolle & Co., Ltd. Central England Scheme.—Switchgear: British Thomson-Houston Co., Ltd. South-East England Scheme.—Overhead transmission lines (Thames crossing): Callender's Cable & Construction Co., Ltd. Switchgear: Ferguson, Pailin, Ltd.

A Submarine Power Cable for Penang.

A cable of unusual interest has been manufactured at the Woolwich works of SIEMENS BROTHERS & Co., LTD. It is to be used for the submarine transmission of power in Penang, Malaya, is insulated with impregnated paper, and is of the three-phase six-core type for operating at 11,000 volts. Its length is 8,700 yards (nearly 5 miles) and its diameter is 4.02 inches, while the weights of some of its constituent parts are as follows: 22 tons of copper, 96 tons of lead, 94 tons of iron wire, and the insulation and other materials make up a total weight of 270 tons. The feature of particular interest is that the cable is being lead-covered and armoured in one complete length without joints. The armouring operation was commenced on Monday last (December 29th) and is expected to be completed to-day (January 2nd).

Conditions in the Engineering Industry.

The Times reports that the Executive Committee of the Federation of Engineering and Shipbuilding Trades, meeting in London last week, considered a letter from the Engineering Employers' Federation, inviting the unions to a conference in January to discuss the position of the engineering industry and the question of production costs. It was decided that a fuller conference of the unions concerned should be convened, but the invitation will almost certainly be accepted. Leaders of the unions incline to the opinion that the employers will not propose a reduction of the ordinary wage rates, but will concentrate on a revision of working conditions. It is thought probable that the employers will suggest modifications of the overtime and night-shift rates, the guaranteed day, apart from piece-workers, and a reduction of the margin in the percentage between piece-workers and time-workers. At a meeting held on Tuesday last the trade unions decided to accept the employers' invitation.

" English Electric " Activities in 1930.

A review of the activities of the ENGLISH ELECTRIC CO., LTD., during the year just ended reveals that a number of important contracts were placed or completed in that period. Among the leading items were two 30,000-kW turbo-generator sets which were put into commission at Bradford and West Ham, respectively. An order for a set of similar size was received from the Yorkshire Electric Power Co. during the year. A number of Fullagar opposed-piston Diesel engines are in hand; they range in size from 750 to 1,500 b.h.p. in four- to eight-cylinder units, coupled to generators and include two further units for the Admiralty. Among several important orders for hydro-electric plant was one for an 18,000-h.p. turbine coupled to a 15,000-kVA alternator for the Vancouver Island Power Co., and a Canadian order for a 6,000-kVA vertical-shaft alternator. Two English Electric 16,666-kVA alternators at Waitaki (N.Z.), three 12,350-kVA sets for the Perak River project, and the five 9,000 h.p. sets for the Lochaber development were put into commission during the year. Other hydro-electric sets delivered included the 17,000- and 22,000-h.p. machines for the Grampian Scheme. The traction department also received a number of good orders, notably those for a hundred control equipments for the Liverpool Corporation and for 450 controllers for Glasgow. The trolley 'bus orders received covered 36 for the L.U.T. and 12 for Bradford. The equipment ordered by the South Indian Railway Co. in 1929 was delivered during last year; it comprised 17 train units, each consisting of a motor coach and two trailing coaches, together with four electric freight locomotives. In view of the advance made in rotary-convertor manufacture in Japan, it is satisfactory to learn that the company has received an order from that country for three complete sub-station equipments each consisting of four 1,000-kW rotary convertors with the necessary equipment. A number of orders for industrial locomotives were also received from various sources. The company says that 1930 was a record year for transformer orders, the total kVA value exceeding 640,000, the bulk of which (504,000 kVA) is attributed to the Central Electricity Board. Large orders for switchgear were placed with the company during 1930, the customers including the Plymouth and Preston Corporations and the Central Electricity Board. Orders received for medium and large machines only, excluding power station plant, aggregated nearly 100,000 h.p.; mention is made particularly of plant supplied to Poland, Canada and New Zealand. Motors for steel works have been ordered by a number of firms, the principal one being Brown, Bayley's Steel Works, to which a 6,000/12,000-h.p. motor and attendant motor-generator set are being supplied.

In addition to the foregoing, good orders for rotary convertors, frequency-changers and motor-generators have been received, while the business in small industrial machines was well maintained.

American Activities in South America.

A *Reuter's Trade Service* message from Buenos Aires says that advance agents of a syndicate of electrical manufacturers, with head offices in New York, have arrived there to take part in an initial canvass of the South American markets for the sale of electrical machinery and appliances on an unprecedented scale. In Argentina electric refrigerators are found in most of the large stores, shops and better-class private houses, and several new intallations have been made in hotels and apartment-houses. Most of the local agents who have been appointed express themselves as hopeful regarding future business. These representatives appear to be in possession of ample funds for advertising, and their energies are being directed mainly towards active competition with Swedish electric refrigerators. In Brazil electric ice-making and refrigerating machinery meets with a fairly steady sale, and is making headway for home use. Electrical machinery for manufacturing ice-cream has had an encouraging share of the market, and among motor-driven appliances selling moderately well are oscillating electric fans, vacuum cleaners and floor polishers; electrical sewing-machines are being sold in larger numbers, and beverage mixers, coffee-grinders and barbers' electrical appliances are becoming better known. Chile offers a good market for electrical goods, and an advertising campaign is about to be initiated in this State aiming specially at interesting hotel, restaurant and café proprietors, among whom electric refrigerators have found satisfied and consistent purchasers.

Wages in the Cable-making Industry.

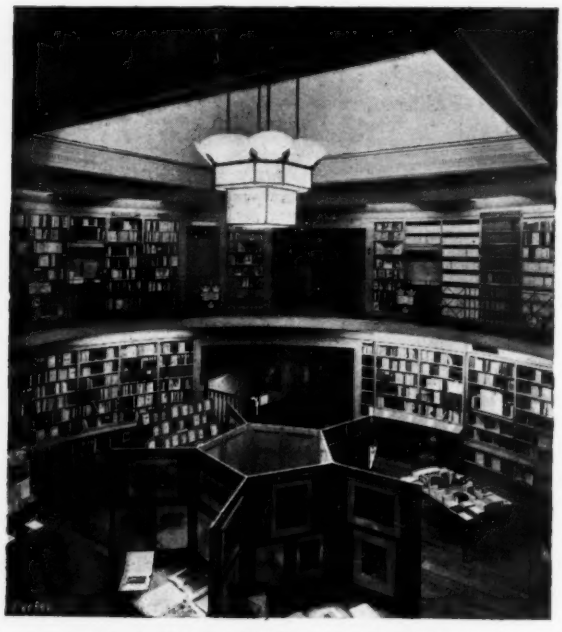
We are informed by the National Joint Industrial Council for the Electrical Cable-Making Industry that there will be no " cost of living " alteration in wages on the third pay-day in January.

In Grandfather's Day.

In their advertisement in this issue Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., show how they would have advertised their products in Early Victorian days. The artist has captured the spirit of the time very well and the letterpress is a good travesty of the rather heavy style then prevalent.

The Lighting of a West End Showroom.

The accompanying illustration shows an attractive lighting fitting specially designed by Messrs. Best & Lloyd, for the showroom of Messrs. John & Edward Bumpus, Ltd., 350, Oxford Street, W.1. As will be seen, the showroom is lined



A Best & Lloyd Fitting in a Bookshop.

with bookshelves, and this modern lighting fitting provides the good illumination which is essential to the easy selection of books. Incidentally, the picture shows an exhibition of Oxford books dating from 1478.

Manufacturing in Canada.

The first of a series of reviews of "The Manufacturing Industries of the British Empire Overseas," dealing with conditions in Canada, has been published by Messrs. Erlangers, Ltd., bankers. This collates in an excellent manner a vast amount of information regarding Canadian industrial production and trade and is illustrated by five large inset diagrams. The foreword to the series touches briefly upon the future fiscal policy of this country as affecting inter-Imperial trade; the desire of the Dominions to establish "secondary" industries for themselves, even to the extent of exporting; existing preferential treatment of British goods, and kindred matters. The object of the reviews is said to be not the discussion of the merits of these subjects, but to provide information regarding the manufacturing industries now developed in the British Empire overseas. Canada has a population estimated at 9,800,000 in 1929, more than half of which is in the Provinces of Ontario and Quebec. This small population has reached such a state of industrial development that in 1928 there were 23,379 factories in the Dominion, representing an investment of £956,059,204, with a gross output valued at £753,970,072. Among these were 137 establishments producing electrical apparatus and supplies, employing 18,193 people and producing £18,734,490 worth of goods. There were also 1,049 central electricity stations with an output valued at £28,738,491. Of the total power used in industry 70 per cent. is electric. The brochure shows that new duties were imposed on electrical apparatus in September last and it is thought that this was a protective move aimed primarily at the few imports from the United Kingdom which have been competing with products of Canadian factories. In 1930 the total value of electrical apparatus imported into Canada was £6,835,496, of which £4,882,150 came from the United States and only £545,440 from the United Kingdom. It is said that one of the main causes which contribute to the insignficance of imports from the United Kingdom is the fact that many large buyers of electrical plant are institutions which are nominally Canadian but are dominated by American finance. In another part of the review it is shown that while over 1,400 important American manufacturing firms have established branches in Canada only 70 branch factories have been established by British manufacturers. The authors indicate how Canada's future is linked up with Great Britain's and show that the continuance of her progress is dependent upon the finding of markets for her agricultural products. The review should provide useful matter for the student of Canadian and Empire affairs.

The South African Economic Mission.

At a recent meeting of Press representatives Lord Kirkley, the chairman of the Economic Mission to South Africa, outlined in advance of publication the recommendations which will appear in the Mission's report. Stress was laid on the need for the combined representation of United Kingdom firms manufacturing non-competitive allied lines, and upon the necessity of more frequent visits to South Africa by responsible members of firms interested in the market. The methods of appointing South African agents were criticised, and in the Mission's opinion British manufacturers did not realise that effective advertising was as important in the Union as in this country. Dealing with the continued study of commercial conditions in South Africa the Mission was proposing that a separate Trade Commissioner should be appointed for Northern and Southern Rhodesia; this official could probably cover Nyasaland as well. The Mission was also urging that individual industries should appoint their own representatives to make special investigations in South Africa.

The B.I.F. Catalogue.

The catalogue of exhibits in the Birmingham Section of this year's British Industries Fair is entirely different from its predecessors. In previous years the brief notes upon the exhibits have been classified in stand order—a convenient arrangement in some respects—supplemented by an alphabetical index of exhibitors' names. This time the practice adopted for the London Section has been followed. That is, the notes are arranged under the exhibitors' names in alphabetical order, the stand number being shown in block type. The classified index of exhibitors has also been reconstructed in a manner which makes it both more thorough and easier to refer to. To this classified section there is also an alphabetical index, which is reproduced in nine languages. The services of interpreters speaking these languages will be available to visitors to the Fair.

A New London Refrigerator Showroom.

Up-to-date showrooms and offices have recently been opened at 169, Regent Street, W., by the INTERNATIONAL REFRIGERATOR CO., LTD., who are now sole distributors throughout Great Britain of B.T.-H. all-steel electric refrigerators. Designed by one of London's most prominent architects, the ground floor showroom is carried out on futurist lines with monel metal walls, staircase and entrance. A well-arranged scheme of lighting permits of separate searchlight beams from a central point, each directed to display a B.T.-H. refrigerator to best advantage. Sixteen "X-ray Major" shop window floodlights with parabolic reflectors, made into spotlights by the insertion of a control ring, are used in each display window to give added brilliance, the whole being arranged so that a view of the entire exhibition can be obtained from any point outside. The exterior is handsomely designed with coloured neon electric signs adding a finishing touch. A large section of the first floor has been devoted to a sales school, which is unique in its appointments. Here dealers' salesmen will undergo intensive training, before returning to their various territories to commence active operation.

The International Refrigerator Co.'s New Showroom.

Book Notices.

"The Romance of Hatton Garden," by H. Marryat, M.I.E.E., M.I.Mech.E., and Una Broadbent, M.A. (Oxon). Pp. 136; illustrated. London: James Cornish & Sons. Price 6s. net.—This is not, as might be supposed from its title, a tale of diamond-dealers' adventures, nor, having regard to the authors, an account of electrical engineering activities in the vicinity. It is a painstaking study of the affairs of a quarter of London with many historical associations, written in a readable style. The man who gave his name to Hatton Garden—Christopher—established his residence there on the northern edge of the city in 1576, but before his day the Bishops of Ely had long had a town residence in Ely Place. Christopher founded a dynasty that lasted until 1760 by which time the estate had grown considerably, and its growth is carefully traced. St. Etheldreda's, which dates from the end of the thirteenth century, is dealt with in a separate chapter. We have read the little work with interest and recommend it to all readers who love to delve into London's past.

Hints on the prevention of accidents in internal transport in works are given by Sir Gerald Bellhouse, Chief Inspector of Factories, Home Office, in the December issue of "On Guard," published by the National "Safety First" Association. Articles on "Accidents and the Human Factor" and "Avoiding Colds and Winter Infections" are also included in this issue.

"Proceedings of the American Society of Civil Engineers." December, 1930. Price, $1.00.

"Memoirs and the College of Science," Kyoto Imperial University; Series A, Vol. XIII, No. 6, November, 1930.—X-Ray Studies on Paraffin Wax and Vaseline.

"Radio-activity and Radio-active Substances," by J. Chadwick. Third edition. Pp. xii+116; figs. 33. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

"Modern Radio Communication," by J. H. Reyner. Third edition. Pp. xi+259; figs. 121. London: Sir Isaac Pitman and Sons, Ltd. Price 5s. net.

Mavor & Coulson's Expansion.

Considerable additions were made to their works and offices during the past year by Messrs. MAVOR & COULSON, LTD., Glasgow. The *M. & C. Apprentices' Magazine* now states that within the last few weeks the company has purchased the Kelvinside Weaving Factory at Kirkintilloch, to which early in the New Year the Switchgear Department will be transferred and operated as a subsidiary company under the title of "M. & C. Switchgear, Ltd."

Association of Ex-Siemens' Men.

A smoking concert will be held by this Association at Gatti's Restaurant, King William Street, Strand, W.C.2, on January 28th. Tickets are 3s. each and guests will be welcome on this occasion. Mr. J. Snow Huddleston, Dagenham Dock, Essex, is the hon. secretary, and he will be pleased to give particulars of the Association to any intending members.

A "Siemens" Currency Note.

The *Daily Mail* recently reproduced a photograph of a 20-mark note issued by the German Reichsbank. This bears a portrait of Wernher von Siemens, and is the first of a series designed to illustrate the "creativeness and aspirations of the German people."

New French Company.

Among the companies recently formed in France is La Société l'Hydro-Electrique, Paris (10 Rue Vezelay), capital £800,000, to finance hydro-electric undertakings.

For Sale.

Manchester Corporation Electricity Department invites tenders for the purchase and removal of second-hand plant.

Messrs. Joseph Sankey & Sons, Ltd., have a quantity of electrical equipment for sale, including rotary convertors, switchgear and transformers.

A stock of lighting fittings is to be sold by auction on January 8th by Mr. E. Fryett, auctioneer, at the sale rooms, Bartlett's Passage, Fetter Lane, E.C.4.

Power plant from dismantled tin mines is offered for sale by Messrs. Geo. Cohen, Sons & Co., Ltd.

(See our advertisement pages to-day.)

Unemployment.

There was a decrease of 7,370 in the number of registered unemployed during the week ended December 15th, the total at that date being 2,299,592, as compared with 2,306,962 on December 8th, and 1,303,557 on December 16th, 1929.

Municipal Trading in Cape Town.

The Retail Traders' Association of the Cape Peninsula has complained of the methods adopted by the Cape Town Municipality in selling electrical apparatus and appliances. A general dealer's licence was issued to the Electrical Department, but the Association is not satisfied that all the requirements of the law have been complied with. The Association takes exception to the conditions attached to the sale of appliances, and states that there is no doubt that the Council is carrying on a trade in the ordinary sense of the term. A letter has been sent to the Town Clerk with the object of finding out the position.

The International Lamp Market.

It is calculated that the world requirements in incandescent lamps are met to the extent of 96 per cent. by the International Lamp Syndicate, leaving only 4 per cent. to the small group of outside makers, and the position is stated to be further changing in favour of the members of the syndicate. Now reports are being circulated from Moscow that Russia is about to enter into competition in the free markets and is already offering glow lamps in certain European countries, as well as in Argentina, Brazil and Chile.

Social Events.

The Mid-East England contract staff of the PIRELLI-GENERAL CABLE WORKS, LTD., had a most successful evening on Saturday, December 20th, when Mr. D. H. Robinson presided at dinner over a party of 120 members of the staff and guests at the Strafford Arms Hotel, Wakefield. The guests included Mr. Longman, of the Central Board, Mid-East Area, Mr. Warnock, of Messrs. Merz & McLellan, and members of the staffs of the Board and consulting engineers. The main contractors, the General Electric Co., Ltd., were represented by Mr. H. V. Bartlett, and members of Pirelli-General's staff from the South-East England scheme, the Central England scheme, and head office, Southampton, were present. A toast to the Central Electricity Board and consultants, was proposed by the chairman, and was replied to by Messrs. Warnock and Longman. The Pirelli-General Cable Works, Ltd., and the G.E.C. were also toasted. The proceedings closed with a musical programme contributed by members of the Pirelli-General staff.

A very merry evening was spent at the Hotel Grand Central, Marylebone, on December 20th, on the occasion of the seventh annual staff dinner of Messrs. T. CLARKE & CO., LTD. Some two hundred employés and their guests were present, the gathering being presided over by Mr. E. J. Clarke, managing director of the company. The toast of the "Firm" was proposed by Mr. Bray, who referred to the amicable relationship which existed between the heads of the firm and the employés. The company, he said, consisted of several parts and it was through the excellent co-operation and good feeling between these various parts that the firm of T. Clarke & Co. owed its continued success. Proposing the health of "The Guv'nor," Mr. Hurrell said he was certain that all his colleagues would agree with him that they were lucky in the choice of their employment and that none of them could desire a better "boss" than Mr. Clarke. Replying, Mr. Clarke spoke of the progress of the company and mentioned some of the successful contracts which had been carried out recently. Mr. Robinson, manager of the company, proposed the toast of the "Visitors and Ladies," Mrs. Simpson and Messrs. Weekes, Broome and Bush responding. The toasts were interspersed with musical items by several well-known artistes. The complete success of the evening's arrangements was due to Mr. Heskins and a very conscientious social committee.

Messrs. MARRYAT & PLACE held their annual staff functions on December 20th. In the afternoon Mr. and Mrs. Marryat entertained about 300 children of all ages and sizes, who made the utmost number of minutes out of three happy hours. An observer could not but reflect that, great as have been the changes in social habits among adults since the beginning of the century, human nature in embryo (and therefore in its fundamental character) remains much what it was, enjoying the same things with the same zest. The old dance tunes and games are still popular, it seems; Christmas crackers and caps, sumptuous teas, sliding on slippery floors, and conjuring marvels and clowns have evidently lost none of the allure they once held (and perhaps still hold) for those who are now corporate members of the I.E.E. Enthusiasm may be said to have reached its height with the advent of the clowns, which provided a fitting climax to an afternoon that many who may play a part in the future of the electrical industry will doubtless long remember.

It was the adults' turn in the evening, when the staff dance was held at Holborn Hall, Gray's Inn Road, W.C. Dancing commenced early in the evening, and it soon became evident that the spirit of Christmas was early abroad. There were about 500 dancers, including mothers and "sisters," and there appeared to be many more. However, "the more the merrier" seemed to be the popular phrase of the evening, and the dance floor was reluctantly abandoned at a late hour.

The staff of the EDISON SWAN ELECTRIC CO., LTD., held a whist drive and dance at Ward's Café, Leeds, on December 17th, which was attended by the whole of the members of the staff and their friends, including friends of the subsidiary companies, making a total attendance of 85. The prizes were distributed by Mr. E. G. Sellers, district manager at the Leeds depôt. The whole of the arrangements for this successful event were most efficiently carried out by Mr. Bagshaw.

The annual dinner of ARON ELECTRICITY METER, LTD., was held at the Holborn Restaurant on December 23rd. The managing director, Mr. Harry Kahn, was in the chair, supported by all the officials of the company, and a large gathering of the firm's workpeople were present. After a few informal speeches an enjoyable entertainment was provided by the Roosters Concert Party.

The E.D.A. January Programme.

With the completion of the Shop and Display Lighting Campaign, the January programme of the British Electrical Development Association draws particular attention to the second section of the Eda Electric Homes Campaign, and says that a general programme and sales and publicity calendar for the period January to June, 1931, will shortly be issued. The sub-title of the campaign is "Three Plug Points," and the Association's advertisements in the National Press, a list of which is given in the programme, will emphasise the installation of more plug points. The advertisements for the local Press are in a similar strain, and as usual, space is provided for the local dealer's name and address. Particulars of the window display for the month (illustrated in our last issue) are given, together with a list of materials required, while illustrations and prices of posters for January are included. A price list is also given of literature dealing with the heating and lighting of domestic and shop premises.

Recent Contracts.

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has been successful in obtaining an important order for two 75,000-kW turbo-alternators from the County of London Electric Supply Co., Ltd., for the new Barking extension, the consulting engineers being Messrs. Merz and McLellan.

The ENGLISH STEEL CORPORATION, LTD., has in hand at the Vickers Works, Sheffield, the production of shafts for the turbines to be installed at the Beauharnois (St. Lawrence) hydro-electric development. These are 38 in. in diameter and will each weigh 36 tons after machining.

Trade Announcements.

MR. F. MARTIN BLAIR, Audrey House, Ely Place, E.C.1, states that his telephone number is now Holborn 4561.

Messrs. HASLAM & NEWTON, LTD., have installed an additional telephone line at their offices at Imperial Buildings, 56, Kingsway, W.C.2, and their telephone number has been changed from Holborn 0531 to Holborn 0623 and 0624.

Messrs. CUNNINGHAM, BEARD & CO., have removed from 6, St. Mary Abbots' Terrace, Kensington, to 146, Kensington High Street, W.8.

The GENERAL ELECTRIC CO. (INDIA), LTD., has removed its Madras branch from 100, Armenian Street, to Magnet House, Mount Road, Madras.

Bankruptcy Proceedings.

J. A. HARTIGAN and G. J. D. HARTIGAN (London Fan and Motor Co.), electrical engineers, 81, Charlotte Street, Tottenham Court Road, W.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1, released October 30th.

W. H. EDWARDS, electrical engineer, The Docks, Milford Haven.—Trustee, Mr. T. H. Watkins, 4, Queen Street, Carmarthen, released November 28th.

G. F. WATTS, electrical engineer, &c., "Sherborne," Clifton Road, Coulsdon.—Receiving order made, December 16th, on a creditor's petition. First meeting, January 5th, at 29, Russell Square, W.C.1; public examination, January 21st, at the County Court, Scarbrook Road, Croydon.

R. J. IRVING, wireless dealer, 4, Bridge Road, Kirkstall, Leeds.—First and final dividend of 3s. 3d. in the £, payable January 14th at the Official Receiver's office, 21, Bond Street, Leeds.

J. BAINTON, electrician and radio engineer, 86, Wheelock Street, Middlewich.—First and final dividend of 4s. 8¾d. in the £, payable December 30th at the Official Receiver's office, 12, Lonsdale Street, Stoke-on-Trent.

J. A. MORGAN, radio dealer, Old Queen's Head, Crickhowell.—Last day for receiving proofs for dividend, January 13th. Trustee, Mr. E. Owen, 34, Park Place, Cardiff, Official Receiver.

Company Liquidations.

ZONE DYNAMO AND MOTOR PATENTS CO., LTD.—A meeting of members is to be held on January 26th at the offices of Messrs. J. W. Best & Co., 94, Old Broad Street, E.C.2, to receive an account of the winding up of the company by the liquidator, Mr. J. J. Reid.

SMITH BROS. (NORTHAMPTON), LTD.—A meeting of members will be held on February 2nd at 68, Derngate, Northampton, to receive an account of the winding up of the company by the liquidator, Mr. A. W. Smith.

CHILI TELEPHONE CO., LTD.—Winding up voluntarily. Liquidator, Mr. W. G. Mare, Connaught House, 63, Aldwych, W.C.2.

CAWTHORN, LTD.—Particulars of claims by January 31st to the liquidator, Mr. R. P. Winter, 16, Market Street, Newcastle-upon-Tyne.

Calendars, Diaries, &c.

The E.D.A. calendar for 1931 has a simple but effective design and neat monthly slips. It can be obtained from the Association in quantity at very reasonable prices with the purchaser's name and address printed upon it.

A pad of bold-figured daily slips on a businesslike card comprise the 1931 calendar of Messrs. T. J. GRAINGER & CO., LTD., Newcastle-on-Tyne.

We have once again received a neat pocket diary, with a fold-over cover, from Messrs. FRANCIS POLDEN & CO., LTD., Cannon Street, E.C.4. The company has also sent us a calendar equipped with a date-marking device.

From Messrs. GEORGE P. COSWAY, LTD., Nuneaton, we have received a wall calendar comprising monthly sheets with very clear figuring.

Messrs. HILDICK & HILDICK, Walsall, have again employed a representation of a bunch of tubes, typifying their business, for their 1931 calendar.

A novel ashtray has arrived from the WARDLE ENGINEERING CO., LTD., Old Trafford, Manchester. It takes the form of replicas of the company's focusing and skirted dispersive-type reflectors spun together to form a sort of chalice finished in black bronze.

A useful-sized calendar-blotter has been received from the HART ACCUMULATOR CO., LTD., Stratford, London, E.15.

We have again received a telephone number record card from the COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD. This is illustrated by an allegorical electrical design based on the story of Aladdin.

A thoughtful blue-eyed lady adorns the 1931 calendar of Messrs. DOWNES & DAVIES, Stanley Street, Liverpool.

A handsomely-bound desk memorandum pad of convenient size has reached us from the ENFIELD CABLE WORKS, LTD.

"The Moon Hath Raised her Lamp Above" is the title of a moonlit seascape on the January sheet of a calendar sent us by MR. SAMUEL BAXTER, Greyhound Road, W.6. The succeeding monthly sheets are similarly illustrated.

From Messrs. F. PARKS, LTD., Newman Street, W.1, have sent us a refill for their desk calendar.

Messrs. J. H. TUCKER & CO., LTD., Birmingham, wishing us "a full measure of success," have sent us a three-fold 12-in. steel rule.

A pencil sketch of the old houses in Holborn is reproduced on the calendar of Messrs. LIONEL ROBINSON & CO., 3, Staple Inn, W.C.1.

An excellent reproduction of an oil painting of Mr. T. A. Edison appears on the calendar of the NEW DISTRIBUTORS OF EDISON STORAGE BATTERIES, LTD., Victoria House, Southampton Row, W.C.1.

A serviceable wall calendar with large daily slips has come from Messrs. H. C. DAVIS & CO., LTD., 1, The Pavement, Clapham Common, S.W.4.

The 1931 calendar of Messrs. C. A. PARSONS & CO., LTD., Newcastle-on-Tyne, is composed of monthly sheets each of which bears a picture of the company's works and products.

The "SOLUS" ELECTRICAL CO., Judd Street, W.C.1, has sent us a neat calendar with black-figured monthly slips.

Patent Restoration.

An order has been made restoring Letters Patent No. 228,905, granted to Helen Kanders for an invention entitled "Improvements in Sound Amplifiers."

New Municipal Showrooms.

Rochdale Corporation's new electricity showrooms and offices which have been built at a cost of over £20,000, have now been opened. The new building is of three storeys complete with workshops, stores, and display and demonstration rooms. In the basement there is a heating chamber and substation, the latter being used for the supply of electricity to the showroom and neighbouring property. On the ground floor is a fittings display room, model kitchen, bathroom, dining room, offices, stores for small electrical goods and an electric passenger lift to the upper floors. On the first of these are the offices of the borough electrical engineer, accounts department, meter reader's rooms, &c. There are a demonstration kitchen, model bedroom and model washhouse on the second floor with rooms set aside for the display of radiators, water heaters and general appliances. The whole of the third floor is laid out as workshops and store rooms for the installation department.

As the present electricity showroms of Kingston-on-Thames Corporation are inadequate, premises at 17, High Street are to be purchased and equipped for showroom purposes, subject to sanction being received to a loan for £3,000 to cover the purchase price and cost of repairs.

Short Time at Philips' Glowlampworks.

According to a Brussels report, owing to a falling off in demand it has been found necessary to reduce the working hours at the factory of the Philips' Gloeilampenfabrieken, at Eindhoven, Holland.

Swedish Foreign Electrical Trade.

The imports of electrical machinery into Sweden during October last were valued at £162,430, bringing up the total for the first ten months of last year to £1,113,020, as compared with £845,890 in the corresponding period of 1929. The imports are small in comparison with the exports of Swedish electrical machinery, which in October last amounted to £355,250, making a total for the ten months of £2,609,375, as compared with £2,449,605 in the corresponding period of 1929.

New Catalogues and Lists.

The EVERHOT ELECTRIC CO., LTD., 9-15, Oxford Street, London, W.1.—A leaflet describing the new "Everhot" portable electric cooker.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, Westminster, London, S.W.1.—The December London stock list of

electric motors, drills, switchboard instruments, circuit breakers, and domestic appliances. Also particulars of the new "Midget Furniculus" one-bar fire and coloured leaflets illustrating the "Furniculus" two-bar fire and the "Carnifex" 1 kW oven.

The AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., Winder House, Douglas Street, London, S.W.1.—An illustrated and priced catalogue giving particulars of the "Douglas" and "Macadie" automatic coil winders and the "Avometer" measuring instruments.

HOLLINGS & GUEST, LTD., Thimble Mill Lane, Birmingham.—An illustrated list (No. A.113) of hydraulic forging and flanging presses and hydraulic riveters; also particulars of pumps and accumulators for working these.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A leaflet setting forth the merits of "Simplex" electric signs.

The ENFIELD CABLE WORKS, LTD., 292-302, High Holborn, London, W.C.1.—Net prices and data of the "Enfelite," "Enfelloy," and "Enfelbond" wiring systems; also trade price lists of "Enfield" v.i.r. and pure rubber flexible wires and "Vicma" and "Vinazo" rubber-sheathed cables.

The SYNCHRONOME CO., LTD., 32-34, Clerkenwell Road, London, E.C.1.—An illustrated catalogue of "Synchronome" electric clocks. A description is given of a new free-pendulum-type master clock.

GEO. COHEN, SONS & CO., LTD., 600, Commercial Road East, London, E.14.—A comprehensive general catalogue of modern machinery covering the bulk of the company's stocks.

FERRANTI, LTD., Hollinwood, Lancs.—List W534, giving full particulars of "Ferranti" 3-valve, a.c. mains radio receivers.

CUTHBERT ANDREWS, 47, Red Lion Street, London, W.C.1.—Instruction card of practical dark-room hints for X-ray workers.

The LONDON ELECTRICAL CO., 1, Sherborne Lane, King William Street, E.C.4.—Catalogue 1,000, sections B and S, dealing, respectively, with bells, indicators, pushes and telephones; and lampholders, switches and other accessories. Also a net trade price list of v.i.r. cables and flexibles.

The BRITISH HANOVIA QUARTZ LAMP CO., LTD., Slough.—An illustrated booklet describing the "Homesun" ultra-violet-ray lamp.

MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A folder containing an interesting description of the "M. & C." face belt conveyor.

Prices of Materials.

Messrs. F. Smith & Co., report, December 30th: Copper (electrolytic) bars: £51, £5 15s. dec.; ditto ditto sheets, no change; ditto ditto wire rods: £61, £5 15s. dec.; ditto ditto h.c. wire, 7¼d., ¼d. dec. Silicium bronze wire, 9¼d., ¼d. dec.

Messrs. Edward Till & Co. report, December 30th: India-rubber, Para fine: 5¼d., ¼d. dec.

Messrs. James & Shakespeare report, December 30th: Copper bars (best selected), sheet and rod: no change. English pig lead: no change.

Lighting and Power Notes.

Barking.—LOAN.—The Urban District Council Electricity Committee is applying for sanction to a loan of £10,000 for the purchase of meters.

Brighton.—LIGHTING OF TENNIS COURTS.—The Corporation has asked the Parks Committee to consider a suggestion for the provision of artificial lighting at hard tennis courts.

BULK SUPPLY CHARGES.—Reporting on the bulk supply to Shoreham, the borough electrical engineer proposed at a recent meeting of the Electricity Committee that a two-part tariff should be substituted for the existing flat rate tariff. The new tariff which he proposes is £5 per kW of maximum demand per annum, plus 0.2d. per kWh with fuel at 20s. per ton, with a variation of 0.025d. per kWh for each shilling per ton increase or decrease in the average price of fuel delivered into the bunkers at Southwick. The Committee agreed to the proposal.

REDUCED CHARGES FOR TELSCOMBE CONSUMERS.—As from the December meter readings the "unit" charge of the domestic contract rate for Telscombe is to be reduced from 1½d. to 1d.

ASSISTED WIRING SCHEME EXTENDED.—The Electricity Committee has authorised the electrical engineer to prepare a scheme for the extension of the assisted wiring system to cover power purposes as well as lighting.

ADDITIONAL PLANT REQUIRED.—The Electricity Committee is applying for sanction to a loan of £3,500 for additional plant in connection with the existing 15,625-kW set at the Southwick works.

ELECTRICITY SUPPLY FAILURE.—A failure of the electricity supply occurred in a large portion of the town on Monday last shortly after 5 p.m. and lasted over two hours. A defective cable was stated to be the cause of the trouble.

Bury.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £2,500 for house-wiring installations, and £2,500 for domestic electrical apparatus.

Canada.—RURAL ELECTRIFICATION IN MANITOBA.—Good progress is now being made in the direction of rural electrification in Manitoba, some 80 farms now receiving supplies of electricity from the Manitoba Power Commission. This body is now distributing power to 41 towns and villages in central and southern Manitoba and a recent survey of the use of electricity on farms connected to provincial power lines shows that farmers are now using electricity for such purposes as cleaning grain, chopping and crushing grain and cutting feed, driving grinding machinery, pumping water, shearing sheep and clipping horses.

Continental.—GERMANY.—The Ryburg-Schworstadt Power Supply Co. is constructing at Schworstadt, on the Rhine, a low-head power station with a total plant capacity of 140,000 h.p. Three important companies are interested in the new undertaking, *viz.*, the Power Supply Co. of North-East Switzerland (distribution pressure 145 kV), the Baden Power Supply Co. (116 kV), and the Rheinfelden Power Supply Co. (45 kV). Consequently the power station must be in a position to supply power to the distribution system of any of the three companies, a condition which has necessitated the use of transformers with three h.p. windings, independent of each other and designed for the whole transformer capacity. The Oerlikon Co. of Switzerland has received an order for two such transformers, three-phase, four-winding, oil-immersed, for outdoor mounting with low-pressure cooling, vacuum-oil tank, and separate oil coolers. The rating of each of the four windings is 32,500 kVA, and the permanent overload capacity of each winding is 35,000 kVA. The pressure ratio is 10.5 kV primary to 48/116/145 kV secondary, with two tappings for ±5 per cent. on the 116 and 145-kV windings. The frequency is 50 cycles and the connections are 10.5 kV delta, 48, 116, and 145-kV star, with fully-insulated neutral point brought out. At the Ryburg-Schworstadt power station they will be arranged with their l.p. windings linked direct to a three-phase generator of the same capacity and with each of the three h.p. windings connected to an extensive h.p. distribution system. The total weight of each transformer, including cooler equipment and oil, will amount to 240 tons.

Croydon.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £3,000.

Darwen.—YEAR'S WORKING.—We have received from Mr. F. M. Fletcher, borough electrical engineer, a copy of the abstract of accounts of the Electricity Department for the year ended March 31st last. The total revenue from the sale of electricity amounted to £36,313, while the working expenditure was £20,322. The gross profit totalled £15,991 and, after providing for loan charges and income tax, there was a net profit of £6,959. The capital expenditure during the year amounted to £7,698, bringing the total now spent on the undertaking to £190,113. Sales of electricity increased from 4,647,691 to 5,153,722 kWh and the number of consumers from 4,107 to 4,498.

Edinburgh.—ASSISTED WIRING.—Reports giving the experience of Aberdeen and Glasgow in the installation of electricity as the basis for a scheme for assisted wiring were submitted at a recent meeting of the Corporation Electricity Sub-Committee. It was stated that in Glasgow the total number of installations carried out up to the end of the year 1929-30 was 23,086 and that the total expenditure was £217,000, an average of £9 8s. per installation. In Aberdeen the total number was 2,166 with a total expenditure of £16,834, the average per installation being £7 15s. 5d. Regarding bad debts the report stated that it was very difficult to quote an accurate figure, as there was always the possibility of recovering part of the outstanding instalments by the future tenant agreeing to take over liability for the remaining instalments. The sub-committee asked its officials to prepare a scheme restricted to owners of houses in Edinburgh.

Grimsby.—LOAN.—The Corporation Electricity Committee is making application for sanction to a loan of £10,965 for duct lines, h.p. feeders and switchgear, required to give a supply of electricity to the Great Grimsby Ice Co., and to provide for additional load at Freeman Street and Riby Street sub-stations. Additional transforming equipment is to be installed at Highfield sub-station at a cost of £445.

Harrogate.—YEAR'S WORKING.—There was an increase from £68,103 to £75,109 in the total revenue of the Corporation Electricity Department (engineer: Mr. Neil McLean) for the year ended March 31st last. The working expenditure (including taxes) amounted to £42,008, as compared with £36,563 in the preceding year, and there was a gross profit of £33,102, as against £31,540. Loan interest and redemption absorbed £21,674, leaving a net profit of £11,427, as compared with £17,344 in 1928-29. The capital expended during the year amounted to £98,335 and included £39,073 for machinery, £19,496 for mains and services, and £16,348 for the purchase of undertakings; the total now spent on the undertaking stands at £502,212. The sales of electricity increased from 7,698,448 to 8,562,676 kWh and the maximum supply demanded from 4,194 to 5,089 kW.

Ilford.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £1,750 for kiosk sites and plant. Sanction has been received to a loan of £50,000 for prospective expenditure on unspecified mains and services.

India.—ELECTRICAL DEVELOPMENTS IN CEYLON.—*Indian Engineering* states that during the past year the Ceylon Electricity Department has been exceptionally busy. Apart from the

maintenance of electrical installations in Colombo and in all towns in the Island where electricity is installed, good progress has been made with the electrification of several other towns and the construction of a new 33,000-V transmission line has been vigorously pushed forward. Transmission lines northwards to Negombo and southwards to Moratuwa are well in hand. A new 3,300-V line has been constructed to extend the Colombo supply to Dehiwala and Mount Lavinia. It may be recalled that in May, 1927, it was decided that no new works in connection with the Hydro-Electric Scheme should be started. Revised estimates have since been drawn up for the whole of the works in connection with the scheme and reports prepared. The first reading of the Hydro-Electric Loan Bill for the completion of the scheme was passed by the Ceylon Legislative Council in March last and the second reading is to be taken shortly.

King's Lynn.—YEAR'S WORKING.—The accounts of the Corporation Electricity Department (engineer: Mr. C. W. Jackson) for the year ended March 31st last record a total revenue of £30,416, with a working expenditure of £16,186. The gross profit showed an increase from £12,462 to £14,230 and, after providing for interest on loans, repayment of loans and income tax, there was a net surplus of £4,108, as compared with £4,296 in 1928-29. During the year the capital expenditure amounted to £22,392 and included £8,037 for mains and services, £4,555 for meters, £3,723 for the changeover in the High Street, and £5,568 for the assisted wiring scheme. Sales of electricity increased from 2,695,419 to 3,130,210 kWh and the maximum demand recorded from 1,690 to 1,780 kW. The average price obtained per kWh fell from 2.15d. to 2.04d.

London.—HAMMERSMITH.—The accounts of the Borough Council's electricity undertaking (engineer: Mr. R. H. Paterson) for the financial year ended March 31st last record a net profit from the sale of electricity amounting to £22,341, whilst the profit from the sale of fittings was £2,443, making a total profit of £24,784. From this sum £10,000 was appropriated for the purchase of meters, and £4,932 provided to liquidate outstanding loan charges on obsolete plant, thus leaving a net surplus of £9,851. A sum of £1,500 was contributed from accumulated profits to the relief of the general rate. During the year, 2,691 wiring installations were provided under the assisted wiring scheme, bringing the total, since its inauguration in 1926, to 6,272. The total number of consumers at the end of the year was 17,661, as compared with 14,105 in the previous year, and electrical energy sold increased from 33,006,952 to 37,232,694 kWh. New cables were laid in 67 thoroughfares and eleven additional substations were provided. The average price obtained per kWh was 1.49d.

ISLINGTON.—The Borough Council Electricity Committee has obtained a grant of 50 per cent. of the interest payments for the extension of electricity mains, at an estimated cost of £20,000.

BATTERSEA.—The Borough Council Electricity Committee is to provide services to 122 premises at a cost of £1,165.

Manchester.—ELECTRICITY CHARGED FOR WITH RENT.—The Corporation tenants have decided overwhelmingly in favour of the proposed change in the system of payment for electric lighting by which a fixed weekly sum is paid with the rent.

Northern Ireland.—OMAGH (CO. TYRONE).—Omagh's electricity scheme is now well advanced, and on Christmas Eve a supply was switched on to a number of shops in the main streets and to the barracks.

Norwich.—LOANS.—The Corporation Electricity Committee is to make application for sanction to loans of £100,000 for prospective expenditure on mains and services, and £15,000 for transformers.

Preston.—LOANS.—The Corporation Electricity Committee is to make application for sanction to the borrowing of £20,000 for cookers and domestic apparatus, £12,000 for meters, and £15,000 for assisted wiring.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

MENAI BRIDGE.—Lighting: From 9d. to 8d. per kWh, less a discount of 10 per cent. for prompt payment. The power charges are also to be reduced.

HECKMONDWIKE.—Secondary power rate: From 1d. to ¾d. per kWh.

Sheringham.—NEW ELECTRICITY CHARGES.—It was announced at a recent meeting of the Urban District Council that Edmundsons' Electricity Corporation, Ltd., proposed to introduce a new system of charging for electricity in Cromer and Sheringham. For private houses there would be a fixed charge based on the floor area, £3 per annum being charged for the first 700 sq. ft. and 10s. for each additional 100 sq. ft. up to 1,600 sq. ft.; the minimum charge in the case of a house with 2,000 sq. ft. of floor space would be £8 8s. For every £1 of this fixed charge, 40 kWh of electricity would be included, energy consumed in excess of the quantity allowed being charged at 1½d. per kWh. For shop and other business premises there would be a fixed charge of £15 per annum per kilowatt of lamps installed, plus 1½d. per kWh consumed, subject to a minimum fixed charge of £6 per annum. A scheme of assisted wiring is also to be introduced shortly.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders authorising (*a*) Norwich Corporation to extend its area of supply so as to include the parishes of Brundall, Blofield and Witton, and part of the parish of Great Plumstead, and (*b*) Chichester Corporation to supply electricity in the parishes of Binderton, West Stoke, Tangmere, Boxgrove, Aldingbourne, Eastergate, and Barnham.

Thanet. — COUNCIL SUPPORTS ELECTRICITY COMPANY'S SCHEME.—The Rural District Council has decided to support the application of the Isle of Thanet Electric Supply Co., Ltd., for a Special Order to supply electricity in the Council's area by means of overhead cables, on condition that the charge will not be more than 1d. per kWh higher than at present paid by consumers at Margate.

West-Midlands Joint Electricity Authority.—SUPPLY TO WELLINGTON AREA.—The Authority is shortly to give a supply of electricity in the Wellington area. The flat-rate charge for lighting will be 8d. per kWh, and for heating, cooking, and other domestic purposes 2d. per kWh, with a discount of 10 per cent. for prompt payment. There will also be alternative two-part tariffs for both residential and business premises and special rates for power supplies.

Tramway and Railway Notes.

Bradford.—INTERIOR FLOODLIGHTING OF TRAMCARS.—A system of interior floodlighting has been introduced in several of the Corporation tramcars.

Continental.—SWITZERLAND.—At a recent meeting of the shareholders of the Emmenthal railway, it was decided to electrify the line from Soleure to Berthoud, and to convert the Berthoud-Langnau section from the existing three-phase system at 750 V, 40 cycles to a single-phase system at 15,000 V, 16 2/3 cycles. These changes have become necessary because certain stations are used in common with the Swiss Federal Railways which already use the latter system. The total cost of the work will be about seven million francs.

BELGIUM.—The Belgian State Railway Exploitation Co. has given instructions for work to be commenced at the workshops at Malines on the installation of electric lighting in a thousand railway carriages and luggage vans.

Dewsbury.—TRAMWAY DECISION REVERSED.—At a special meeting held recently the Town Council reversed its previous attitude towards the Yorkshire (Woollen District) Tramways Co.'s Bill, which seeks powers to replace the tramways in its area by motor-'buses. The Dewsbury Corporation, which is jointly interested in the tramways, has now decided to oppose the Bill and has appointed a sub-committee to carry the opposition into effect.

Halifax.—RENEWAL OF TRACK.—The Corporation Tramways Committee recommends the gradual renewal of tramway tracks at an ultimate cost of £90,000, the question of future renewals on portions not at present approved being left for later consideration. It was stated at a recent meeting of the Committee that if track renewals were undertaken on all routes which need, or soon would need, renewal, the cost would be £200,000, and that the possibility of substituting motor 'buses might be considered.

London.—EXPERIMENTAL TUBE TRAIN.—An experimental train, consisting of six coaches embodying several novel features, has been placed in service by the London Electric Railway on the Piccadilly line. The cars have been built entirely by British labour and all the materials used are also stated to be British. It is understood that the train is being run for the purpose of deciding the most suitable type of rolling stock for use on the extension of the railway now under construction from Finsbury Park to Cockfosters.

Municipal Tramways and Transport Association.—REGENERATIVE CONTROL EXPERIMENTS.—A committee has been appointed by the Association to consider the question of investigation and experiments with regard to the regenerative control of tramcars.

Railway Electrification.—GREAT BRITAIN'S INCREASED MILEAGE.—In the House of Commons on December 19th, Mr. Morrison informed Major Harvey that the route mileage of railways in Great Britain, worked solely or partly by electric traction, and open to traffic at December 31st, 1929 (the latest date for which particulars were available), was 586 miles, an increase of 25 miles, as compared with the mileage at December 31st, 1928, and an increase of 56 miles as compared with that at December 31st, 1927.

Sunderland.—TRAMWAY EXTENSION PROPOSAL DEFEATED.—The Town Council, by a majority of one vote, has rejected a proposal of the Tramways and Highways Committee to extend the Corporation tramway system from Seaburn along the coast to the neighbouring village of Whitburn.

Wolverhampton.—RAILLESS CARS.—The Town Council has decided to substitute railless cars for 'buses on five miles of route.

Telegraph and Telephone Notes.

Canada.—AUTOMATIC TELEPHONY.—The Minister of Telephones for Manitoba has awarded to Messrs. Siemens Brothers (Canada), Ltd., a contract for the supply of additional automatic telephone equipment for use in the City of Winnipeg. The material is to cost about £65,000; its installation will not be effected until next July.

LONG-DISTANCE TELEPHONY. — The three thousand miles which separate Victoria, British Columbia, from Halifax, Nova Scotia, are to be bridged by a direct long-distance telephone circuit between the two towns. This important development in Dominion telephony forms part of the plans outlined by the British Columbia Telephone Company, and the scheme will, it is hoped, be completed in the autumn of this year; at the very latest the line will be opened in the spring of 1932. All the telephone companies on the route across the continent are co-operating; a considerable portion of the line is already laid, and some sections are in service.

International Telephony.—NEW ANGLO-SPANISH CIRCUIT.—The Postmaster-General announces that a new circuit connecting London direct with Barcelona has been brought into service. The new circuit, which will supplement the two circuits already in operation between London and Madrid, has been provided to meet the continued growth of traffic between this country and Spain.

Irish Free State.—TELEPHONY.—During 1930 the number of local calls totalled 19,750,000 and trunk calls numbered 1,960,000, an increase of 560,000 during the year. The number of subscribers in Dublin reached 20,000, the number of instruments in use being 29,000. During the year 13 new rural exchanges and 31 additional call offices were opened; the number of street kiosks in Dublin City is 14.

New Zealand.—TELEGRAPH RATES.—Cable telegraphy rates between Great Britain and New Zealand were reduced on January 1st by Imperial and International Communications, Ltd. The rates to Fanning Island, Fiji, Norfolk Island, and other Pacific Ocean islands served by New Zealand, or by the Suva radio circuit, were reduced also correspondingly.

Norway.—LINE CONVERSION.—The Norwegian telegraph authorities have decided to replace the following overhead telephone and telegraph lines by underground cables: Oslo-Stavanger; Oslo-Bergen, with a branch from Honefoss to Cjovik; Oslo-Nidarso, with a branch between Domaas and Andalsnes; and Oslo-Halden.

Radio-telephony.—JAVA-AUSTRALIA SERVICE.—A wireless-telephone service between Java and Australia was to be officially opened on December 23rd.—*Reuter* (Batavia).

South Africa.—DURBAN TELEPHONE SYSTEM.—A joint inquiry by representatives of the Postmaster-General and the Durban Town Council into the future of the Durban telephone system, which belongs to the Corporation, has broken down. The Minister announced his intention to submit to the Cabinet proposals for the expropriation of the system and has warned the Council that, should the system be taken over, the State could make no financial provision for outlay on any new plant installed on the advice of Mr. Thomas Holme (telephone manager of the Hull Corporation and adviser to Durban municipality) or Council officials. The Durban representatives submit that the Postmaster-General is altogether premature in calling for the valuation of the plant at this juncture, and that, failing his willingness to pursue the inquiry on the lines previously suggested by him, the Council should follow out its own scheme of extensions without delay. The Mayor contends that Government ownership would increase the cost to users and lessen the efficiency of the service.

The Telegraph Service.—DEFICIT.—In reply to a question in the House of Commons the Postmaster-General recently stated that it was thought probable that the deficit on the telegraph services for the current year would be somewhat in excess of £800,000.

YULETIDE CABLES.—Special Christmastide cables of greeting sent to, and received from, its overseas stations by Imperial and International Communications, Ltd., up to early on December 29th totalled 111,387, a decrease of only 730 as compared with the figure for last year. The number of telegrams transmitted to stations abroad since December 15th, when the concession of accepting Christmas and New Year cables at reduced rates came into force, actually shows an increase, being 53,643 as against 51,116 last year. One of the features of this year's Yuletide traffic has been the large number of messages transmitted to the Continent. Hundreds of telegrams have been sent to Switzerland alone.

The Telephone Service.—SUBSCRIBERS' DEPOSITS.—In reply to a question in the House of Commons the Assistant Postmaster-General has stated that subscribers' deposits held by the P.O. amounted to £2,738,000 on April 1st, 1930. The money, he explained, formed part of the general balances out of which, after providing the necessary working balance, payments were made to H.M. Exchequer. No part of this sum was placed on deposit at interest. The fact that the department was thus relieved of the necessity of borrowing its working capital operated to the benefit of subscribers.

Radio Notes.

Australia.—STATE SYSTEM.—The new Commonwealth system of broadcasting was inaugurated by the Post Office on December 22nd, when the Newcastle (N.S.W.) station staged a gala opening programme, which was successfully relaid to Sydney and Melbourne. The Newcastle station, which is equipped with a 2½-kW set made in England by Standard Telephones & Cables, Limited, is one of a chain of twenty 2½-kW stations which will work in conjunction with a smaller number of high-power stations. The percentage of licenced listeners in the Commonwealth now compares favourably with the most highly developed European countries.

Czecho-Slovakia.—HIGH-POWER TRANSMITTER.—When the new transmitter near Böhmisch is ready Prague will have two stations, namely, the existing 5-kilowatt station and the new transmitter, which will have a power of from 60 to 120 kilowatts. There are now 293,000 listeners in the country.

Germany.—NEW STATION.—The erection of a new 75-kilowatt station in the district of Lüneburg, Prussia, is to be begun next spring.

Hungary.—NEW STATIONS.—It is reported that two new 10-kW relay stations are to be opened shortly, and that a 100-kW transmitter is contemplated for Budapest.

Irish Free State.—NEW STATION.—It is now officially confirmed that the new high-power transmitter is to be built at Athlone. The studio will remain in Dublin.

The B.B.C.—YEAR'S WORK.—In a review of its work during 1930, the B.B.C. states that technical progress has been well maintained and sufficient experience has been accumulated of regional broadcasting since a full service of alternative programmes was introduced at Brookmans Park in March, 1930, to justify an optimistic view of the future of dual-programme transmissions. Work on the north regional station, which is situated on the hills above Slaithwaite, near Huddersfield, continues and test transmissions will be possible very shortly. A site for the Scottish regional station was chosen at Westerglen, three miles south of Falkirk, in Stirlingshire, and the building is being put in hand immediately. It will be the third twin transmitting station to be built as part of the Corporation's regional scheme and will, when in operation, replace the existing low-power transmitters at Glasgow, Edinburgh and Dundee. In general, the regional transmitters will follow a standard design. Rapid progress was made with the construction of the future headquarters in Portland Place, London, which will contain some twenty studios, including one capable of accommodating an audience of a thousand in addition to a full orchestra and chorus. Constant liaison has been maintained by the engineering staff of the B.B.C. with Government and broadcasting engineers on the Continent of Europe and in the United States of America, and considerable progress has been made in the relaying of programmes, which has included, for example, the linking of German, Belgian, and British stations for international concerts; pre-eminent among the outstanding technical accomplishments of the year was the relaying of addresses on the occasion of the ceremony of depositing the ratification of the London Naval Treaty in October, which were heard by listeners in America, Great Britain, and Japan. Experiments in television transmissions took a step forward when the first play to be televised, "The Man with the Flower in his Mouth," was produced by the B.B.C. and Baird Television Co. officials. A committee set up at the instance of the Canterbury Lower House Convocation has inquired into the relation between the Church and broadcasting, but has not yet presented its report. The year has witnessed several important changes in the service of broadcast lessons for schools. The Central Council for School Broadcasting resolved to conduct a technical inquiry into reception in schools and has secured the co-operation of outside experts of the National Physical Laboratory and the Department of Scientific and Industrial Research, which are represented on the Council's Technical Sub-Committee. As an interim measure a series of reception tests was instituted in the closing weeks of the autumn term and will be continued next spring.

U.S.A.—METAL TRADE.—Remarkable figures, tracing the development of the American wireless industry and its stimulus to the metal markets, are shown in a statistical survey recently completed by the Electrical Equipment Division of the U.S. Department of Commerce. Over 3,000,000 sets are produced in the country each year, it is estimated. Steel, in strips and bars, is the metal most widely used by the industry, some 110,000 tons being consumed, more than 1,600 of it in the form of screws, nuts, and washers. Copper is next in importance, the consumption being estimated at 12,000 tons: 4,000 tons of aluminium, 1,800 tons of pure tin, 1,500 tons of nickel and its alloys, and 1,200 tons of zinc also enter into the manufacture of sets, speakers, and valves.

Yugo-Slavia.—FINANCE.—Radio-Belgrade, the capital's station, now has 30,000 listeners. Hitherto only 60 per cent. of the licence money was received by the broadcasting authorities. The Post Office retained the remaining 40 per cent. as a tax. In future Radio-Belgrade will receive 65 per cent. of the fees; Zagreb (owing to the smaller number of listeners) 70 per cent., and Ljubljana (being the smallest region) 80 per cent. During the coming year it is hoped, says *World-Radio*, to erect one relay station at Subotica, near the Hungarian borders, and another at Skoplje in Southern Serbia. Belgrade's power will also be increased considerably.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. January 27th. Fuses and heat coils for the protection of telephone equipment. (A.X. 10516.)*

February 3rd. Telephone exchange power boards. (A.X. 10466.)*

February 10th. Telephonists' telephones for common battery working. (A.X. 10569.)*

February 17th. Electric lamps, lamp caps and sockets for voltages from 4 to 50. (A.X. 10643.)*

February 24th. Resistances in vitreous spools ranging from 100 to 4,000 ohms. (A.X. 10642.)*

Barking.—January 12th. U.D.C. Electricity Department. Sub-station switchgear plant. (December 19th.)

Bridlington.—January 19th. Corporation. 11-kV and l.p. cables, boxes, and roadwork; also 11-kV ring-main switchgear, transformers, and equipment. (December 19th.)

Egypt.—CAIRO.—February 23rd. Ministry of Public Works. Generating, distributing, and pumping plant for Naga Hamadi barrage. (A.X. 10664.)*

SAMANOND.—February 28th. Ministry of the Interior. February 28th. Supply and installation of an electrical distribution system for the town. (A.X. 10659.)*

Farnworth.—January 12th. U.D.C. Electricity Department. L.p. switchboard panels. (See this issue.)

Fife.—January 12th. County Council. Electric lighting installations in 60 houses at Glencraig. Schedules, &c., from Mr. W. Williamson, Kirkcaldy (deposit £1 1s.); tenders to Mr. J. M. Mitchell, county clerk, Cupar.

Heston and Isleworth.—January 9th. Electricity Department. Electrical supplies for twelve months. (December 26th.)

Hull.—January 19th. Corporation Electricity Department. Electric lamp-posts and brackets for street lighting. (December 12th.)

Liverpool.—January 22nd. Electricity Supply Department. Twelve months' supply of materials. (See this issue.)

London.—ISLINGTON.—January 16th. Borough Council. Twelve months' supply of electrical and engineers' stores. (December 12th.)

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—February 2nd. Coal unloading cranes and coal-handling plant, including travelling bridge and belt conveyors, in connection with the Barking power station extensions. (December 12th.)

CENTRAL ELECTRICITY BOARD.—January 19th. Construction of site works, foundation works, and buildings in connection with the North-East England Electricity Scheme. (December 12th.)

February 2nd. 132,000-V transformers. (See this issue.)

Manchester.—January 10th. Public Health Committee. Supply and erection of electric bed lift at Crumpsall Hospital, Crescent Road, Crumpsall. Specification and particulars from Superintendent of Works, Public Health Department, Public Assistance Offices, All Saints.

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 26th. 500 ebonite telephone earpieces. (A.X. 10555.)*

Public Works Department. January 27th. 11,000-V switchgear and metering for Mangahao power scheme. (A.X. 10373.)*

February 24th. One set of 110-kVA outdoor switchgear, steelwork and controlling equipment. (A.X. 10507.)*

Plymouth.—January 10th. Corporation. 15,000-kW turbo-alternator with condenser auxiliaries. (December 19th.)

Smethwick.—January 31st. Education Committee. Low-pressure water heating of the Holly Lodge High School. (See this issue.)

South Africa.—JOHANNESBURG.—January 26th. Railways and Harbours. One 5-ton electric overhead travelling crane. (A.X. 10650.)*

February 2nd. Two 150-kW convertors. (A.X. 10668.)*

February 16th. Material for colour light railway signalling. (A.X. 10662.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Southend-on-Sea.—January 21st. Electricity Department. General stores for 12 months. (December 19th.)

Staffordshire.—February 3rd. Education Committee. Installation of electric lighting in several school buildings. (See this issue.)

Contracts Closed.

Amersham.—Rural District Council. Accepted:—
Installation of electric light in houses.—W. Cook; P. West: Chesham & District Electric Light Installation Co., Ltd.

Barking.—Electricity Committee. Recommended:—
Cable.—Metropolitan Electric Cable & Construction Co., Ltd. (£710); Ateliers de Constructions Electriques de Charleroi (£3,782); Derby Cables, Ltd. (£291).

Bournemouth.—Roads Committee. Accepted:—
Wiring for traffic-control signals (£142).—Forest City Electric Co., Ltd.

Croydon.—Electricity Committee. Recommended:—
Sub-station switchgear (£4,350).—A. Reyrolle & Co., Ltd.
General Purposes Committee. Recommended:—
Electrical wiring at Town Hall (£275).—Kingsdown Electrical Co.

Heckmondwike.—Urban District Council. Accepted:—
Five-core armoured cable.—W. T. Henley's Telegraph Works Co., Ltd.

Ilford.—Health Committee. Accepted:—
Battery for electric vehicle (£186).—D.P. Battery Co., Ltd.
Electricity Committee. Accepted:—
Two transformers (£142 each).—Yorkshire Electric Transformer Co., Ltd.
One transformer (£139).—Hackbridge Electric Construction Co., Ltd.

Peterborough.—City Education Committee. Accepted:—
Installation of electric light at the Education Department.—Northants Electrical Installations, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
Sockets and plugs (£2,339).—Hubert Davies & Co., Ltd.
Metal-clad switch and fuseboards (£2,900).—British General Electric Co., Ltd.
House service meters (£4,687).—Hubert Davies & Co., Ltd.
Copper (£4,756).—British Insulated Cables, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Motor and vacuum pump for the sewage works (£201).—W. Jay.

Forthcoming Events.

Physical and Optical Societies' Exhibition.—January 6th-8th. Imperial College of Science, Kensington, W.

Institution of Electrical Engineers.—Thursday, January 8th. Institution, London. 6 p.m. "The Distribution of Energy Liberated in an Oil Circuit Breaker; with a Contribution to the Study of the Arc Temperature" (Electrical Research Association Report). Mr. C. E. R. Bruce.

(Meter and Instrument Section).—Friday, January 2nd. Institution, London. 7 p.m. "Apparatus and Methods for Accurate Maintenance of Large A.C. Energy Meters." Messrs. E. Fawssett and G. E. Moore.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 5th. The University, Liverpool. 7 p.m. "The Cooling of Electrical Machines." Mr. D. B. Hoseason.

(Wireless Section).—Wednesday, January 7th. Institution, London. 6 p.m. "A New Method of Measurement of Resistance and Reactance at Radio Frequencies." Messrs. F. M. Colebrook and R. M. Wilmotte. "A Variable-capacity Cylindrical Condenser for Precision Measurements." Mr. E. B. Moullin.

(Dundee Sub-Centre).—Thursday, January 8th. University College, Dundee. 7.30 p.m. "The Consumer's Point of View." Messrs. E. G. Clark and G. Fowler.

(London Students' Section).—Friday, January 9th. Institution, London. 6.15 p.m. "Mercury Arc Rectifiers." Messrs. A. Dean and M. M. MacMaster.

Institution of Welding Engineers.—Thursday, January 8th Institution of Mechanical Engineers, London. 7.45 p.m. "The Use of Pure Iron Electrodes for Welding Cast Iron." Messrs. H. D. Lloyd and J. S. G. Primrose.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 10th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Earthing of Electrical Apparatus." Mr. J. Vaughan Harries.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

Heating elements for range tops, inside ovens and grillers, all to be fitted with plug-in contacts. Three heat switches, porcelains and fittings for stoves, plug fuses and generally all standardised fitments. The above are required for export only, and we shall be glad to put any makers in touch with our inquirer.

"VEDA" heating elements (believed of Swedish origin).

CHASTA non-flam shades.

Notes.

Smoke-abatement Experiments.

The Ministry of Health has invited the Department of Scientific and Industrial Research to supply reliable information concerning the use of optical methods of estimating the solid contents of emissions from industrial chimneys.

The lack of simple optical methods of this kind has, *The Times* states, rendered ineffective Section (2) (1) of the Smoke Abatement Act, 1926, which empowers local authorities to frame by-laws prescribing the colour, density, or contents of industrial smoke, thereby establishing the presumption that smoke in given cases may have been a nuisance. A few attempts which have been made by local authorities to frame by-laws under this section have been unsuccessful, because, in the absence of adequate scientific information, the by-laws could not contain the specific definition which is essential.

The Department of Scientific and Industrial Research, after consulting its Atmosphere Pollution Research Committee, has responded to the Ministry's request by a decision to develop experimental work which has been in progress at the Fuel Research Station at Greenwich. These experiments, previously confined to one type of boiler, will now be extended to a variety of boilers and methods of firing, and will occupy some months. These extended trials, it is urged, are necessary for a scientific reason. The opacity of smoke, it is claimed, is dependent not only upon the total concentration, but also on the size of the particles. Other variable factors in the determination of the problem are the colour of the smoke particles and the way light falls on them at given moments. The claim is made that, given a wide range of these variables, no physicist would count on finding any close correlation between an optical measurement of the smoke and what, in effect, is its dirtiness.

The experiments at Greenwich have shown that, notwithstanding this theoretical difficulty, there is in practice in the case of the one type of boiler there used a close relation between the opacity and the density of the smoke. The object of studying smoke from other types of boilers is to see whether, with a greater range of variables, the same empirical relation still holds. A hopeful result already obtained is the extent to which the amount of the tar in the smoke affects its opacity. This, it is thought, may prove to be a simple basis for differentiating between smoke which may be considered to constitute a legal nuisance and smoke which may be legally inoffensive.

Although the experiments may be unsuccessful in their primary object of establishing an optical method of measuring the density of smoke, they will probably yield valuable results in the solution of the problem of controlling the efficiency of fuel combustion. In this connection it should be relatively simple to arrange for the automatic control of mechanically stoked furnaces by fixing an optical measuring apparatus in the chimney, which could be designed to regulate the rate of feeding the fuel into the furnace, as well as the draught according to the amount of solid matter in the flue gases.

Such an arrangement would be of value, since it would dispense with the need of special observation of the smoke issuing from the chimney. The investigations already carried out have left no doubt in the minds of the investigators that this would be practicable for individual boilers.

E.P.E.A. Dinners.

The annual dinner of the North-Eastern Division of the Electrical Power Engineers' Association was held at Newcastle on December 13th, Mr. J. H. Low presiding.

The Lord Mayor of Newcastle (Mr. David Adams) thanked the Central Electricity Board for having placed recent electrical contracts in the north-east area.

Mr. R. P. Sloan, chairman and managing director of the Newcastle-upon-Tyne Electric Supply Co., Ltd., said that expenditure in electrical development did not necessarily mean that the trade was good. He was glad that much of the work in connection with the grid scheme had come to local firms, but, as in many instances the prices quoted by the local firms were the lowest, the orders were not placed for charitable reasons. Electrical schemes which were being put into operation were based on the assumption that there would be a cumulative increase in the use of electricity by the population. The country would have to regard the use of electricity from a broad and not a parochial view, or it would not be able to bear the heavy costs of the national scheme: they must develop the sales departments of electrical undertakings. "Unless we can have a greatly increased consumption of electricity per head of the population we shall find the national grid scheme is going to be a hindrance instead of a help."

Mr. Maxwell Buist, district engineer of the north-east area of the Central Electricity Board, proposed "The Association," and appealed to members to support that organisation.

Mr. A. V. Sendall (president of the Association) replied, and reinforced Mr. Buist's appeal.

Other speakers were Mr. A. H. Thwaites (chairman of the Newcastle section), Miss N. Balls (branch chairman of the Electrical Association for Women), and Mr. B. Leeson (chairman, North-Eastern Centre of the I.E.E.).

There was a representative gathering at the Hotel Metropole, Swansea, recently, when the West Wales section of the Association held its ninth annual dinner which was presided over by Mr. Cockburn, Llanelly.

Mr. A. V. Sendell, responding to the toast of "The President and the Association," spoke of the high status of the power engineer to-day, and emphasised the necessity of organising the selling side of the industry, as well as the producing side, and the desirability of having more technical men in contact with the public.

Councillor T. A. Lovell (ex-mayor of Swansea) proposed the toast of the "Electric Supply Industry," and expressed an opinion that one of the best things done in Swansea was the establishment of the power station, and said he looked forward to the super station which would supply, not Swansea alone, but the whole of West Wales.

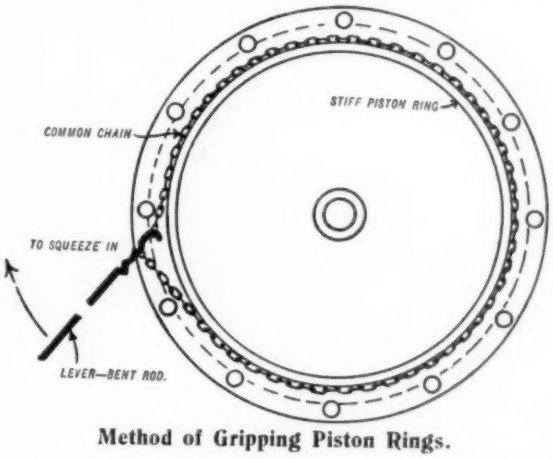
Responding, Mr. W. Biles, Central Electricity Board, complimented Mr. J. W. Beauchamp, C.E.B. district engineer for the area, who had the industry well at heart.

The chairman of the Swansea Electricity Committee, Mr. W. Bevan, also responded, and stated that he was not quite satisfied with the progress of the industry, and he advocated the avoidance of a multiplicity of tariffs if fresh consumers were to be attracted.

Automatic grading of members was suggested by Mr. H. M. Taylor.

A Piston-ring Grip.

For convenience in getting comparatively stiff piston rings into the bore of a cylinder, whether for steam, gas, or oil, a



Method of Gripping Piston Rings.

means of gripping the rings into the necessary diameter is necessary. Mr. J. T. Towlson has sent us the following suggestion: generally a hoop of iron, with ends turned up with which to contract it with the aid of suitable bolts, is used, but, in the absence of such a device, a piece of light chain may be used with a lever for taking hold of the links, in the manner shown in the accompanying sketch.

To get the rings to enter the cylinder bore, constrict with chain and lever, and "bump" the piston (with discretion) with a spar of wood used endwise.

Operation of a High-pressure Steam Station.

Experience gained during the first six months of operation at Gilbert station of the New Jersey Power and Light Co. is reported in *Power*. The plant comprises a 55,000-kW, cross-compound turbo-alternator receiving steam at 1,250 lb. per sq. in., 750 deg. F., from two boiler units designed for 250,000 lb. of steam per hour each.

Control and operation of the plant on one floor without any wall between the turbine and boiler rooms has made the Gilbert plant simpler to operate than existing low-pressure plants, and it has been found that no added *personnel* or higher class of labour is needed than that employed for low-pressure installations.

Operating data now available disclose that during the week of July 26th the plant produced a kilowatt-hour for 0.846 lb. of coal with a heat consumption of 11,866 B.th.u., resulting in a thermal efficiency of 28.75 per cent. The average heat consumption during the months of July and August was about 12,850 B.th.u. per kilowatt-hour. Typical operating data disclose that superheated steam temperatures of 750 deg. F. have been encountered with reheating temperatures of 818 deg. F.

This is stated to be the first published operating data for a plant designed wholly for 1,250 lb. pressure. Comparing the heat consumption with other installations operating at lower pressures, the Columbia station, a 600-lb. per sq. in. reheat plant, produces a kilowatt-hour for about 12,450 B.th.u., and Powerton station, a 650-lb. per sq. in. reheat plant, has averaged 12,546 B.th.u. per kilowatt-hour for a four-month period.

Any conclusion arrived at from these figures that a 1,200-lb. plant is not so efficient as a 600-lb. plant would not, however, be justified, as the Gilbert station has been in regular operation for only six months, during which period of initial operation the staff has been concerned with getting the plant into smooth operation rather than with any attempt to obtain high efficiency.

Association of Public Lighting Engineers.

The office of this Association has been removed from 68 to 64, Victoria Street, London, S.W.1.

Educational.

A course of six lectures on television will be given by Mr. J. J. Denton, A.M.I.E.E., hon. secretary (Members) Television Society, on Thursdays (8 to 9.30 p.m.) commencing January, 1931, at the Borough Polytechnic, Electrical Engineering Department, Borough Road, S.E.1. Fee for students residing in London, Kent, and Essex, 5s.

Tramcar Illumination.

The accompanying illustration was taken by the ordinary lighting inside one of Birmingham Corporation's tramcars. The lighting fittings include Siemens "Majolica" fittings,

Illumination of a Birmingham Tramcar.

traction lampholders and "Silverlux" opal gasfilled traction lamps. As will be seen, the result is a comfortable glareless reading light with an almost entire absence of shadow.

Joint Operation of Gas and Electricity Works.

Among the papers presented to the World Power Conference in Berlin last summer is one by Herr Th. Ploppe on the joint working of gas works and electric power stations. The paper is based on the results of operating such a joint installation at Wik, Kiel, Germany, and it points out that considerable economy can be effected in the purchase of the fuel necessary for the two parts of the plant and also in the handling of the fuel. Moreover, the coke resulting from gas manufacture can be mixed with coal and used for the firing of boilers supplying steam for the turbo-generators.

The Fire at Portishead Power Station.

On Christmas Eve Bristol was plunged into darkness by a fire at the city's new £2,000,000 electricity station at Portishead. In the main generating room there are three turbo-generators, one of 50,000 kW and the other two of 20,000 kW. *The Times* states that through a gland seizing in the high-pressure cylinder of one of the 20,000-kW sets, 800 gallons of lubricating oil burst into flame, shooting 80 ft. high to the roof, which also caught fire through the intense heat, molten lead flowing down on to the machinery. Six men on duty in the building had to make a dash for their lives, the heat being too great to allow them to use fire appliances. Three were slightly burnt

Effect of the Fire at Portishead.

by the oil. Bristol fire brigade and the Portishead brigade checked the fire after three hours. After half an hour's interruption the reserve station at Feeder Road was able to supply all the current needed.

[The fire at the old Temple Back station actually occurred on December 23rd, 1903, that is 27 and not 23 years ago, as generally reported in the daily Press. The earlier disaster was reported in the ELECTRICAL REVIEW of January 1st, 1904. The Portishead power station was fully described in our issues of March 14th and 21st, 1930.—EDS. ELEC. REV.]

Fatality.

Whilst engaged in removing a tramway standard, George Reynolds, an employé of the Llanelly and District Electric Supply Co., touched an underground cable with an iron bar and received a fatal electric shock. David Davies, another employé, also received a severe shock and was removed to hospital in a serious condition.

Colliery Officials Fined.

The *Manchester Guardian* reports that the agent, manager, and electrician of the New Herrington Colliery were recently accused at Houghton-le-Spring, Co. Durham, of offences under the Coal Mines Act arising out of an explosion at the pit in April last when two men were killed. The accused were Arthur Lewis Scott Owen, Robert Cecil Blackbird, and Arthur Atkinson. Owen and Blackbird were charged with failing to provide adequate ventilation, and all were charged with failing to protect the switch-box of an electric coal-cutting machine in order to prevent open sparking. Owen and Blackbird were fined a total of £15 each, and Atkinson £5, and they were ordered to pay 25 guineas costs.

"Toujours la Politesse!"

The Municipal Commissioner of an Argentine township has recently drawn the attention of the "National Interventor" in the province of Buenos Aires to the high prices charged for electricity in his district. He requests the "Interventor" (says the *Review of the River Plate*) to exercise his influence to procure that "the fortunate concessionaire company shall moderate its exigencies and contemplate the situation with humane feeling."

A Novel Wiring Job.

We learn that the makers of the miniature circuit breakers employed in the installation which was described under the above heading in our last issue, p. 1109, were Siemens-Schuckert (Great Britain), Ltd., who have also supplied similar apparatus for other installations in this country.

Depth Sounding for Ships at Sea.

For a number of years the Marconi Company has been engaged in experimenting with sounding devices for use on board ship. The recently formed Marconi Sounding Device Co., Ltd., has selected the well-known Langevin-Chilowsky supersonic process and has elaborated it to suit the requirements and practical economic needs of the British mercantile marine.

The new company owns the world-wide rights of the patents of Professor Langevin and his associates, in addition to all those patents on the same subject which are the property of the Marconi Companies. The system is claimed to make accurate soundings directly underneath the ship on which it

is installed from 2 to 350 fathoms, which are the least and greatest depths likely to be required under present conditions. The apparatus is fully automatic and is set in action by the pressing of a button on the ship's bridge, or wherever it is desired to install the indicator, the depth of water immediately under the ship being indicated at once by means of a pointer which moves over the surface of a scale and remains stationary for about ten seconds at the correct depth. This operation is repeated four times a minute until the apparatus is switched off, and the working of the device is not in any way affected by the speed at which the ship is travelling. The actual operation consists of the emission of an elastic wave through the water, which is directed vertically downwards; on reaching the sea bed the wave is reflected back to the ship's bottom, where a suitable receiver is installed. In the Marconi installation the transmitter and receiver are identical.

Appointments Vacant.

Chief engineer and general manager for Croydon Electricity Department.

Principal for Doncaster Technical College.

Shift charge engineer for Croydon Electricity Department. (See our advertisement pages to-day.)

The Electrical Association for Women.

On December 10th a party of members of the Association visited the works of Messrs. Vac-Tric, Ltd., where they witnessed manufacturing processes connected with vacuum cleaners.

On December 4th a large party of E.A.W. members, consisting mainly of women in the electrical industry and domestic science teachers, visited the showrooms of the Hotpoint Electric Appliance Co., Ltd., when Miss Dorothy Vaughan gave a lecture on "Laundry Problems," which she demonstrated by means of the company's electric washing machine and ironer.

The first annual ball promoted by the Bradford branch of the Association took place on December 18th, when the guests were received by Lady Watson (president) and her husband, Sir Francis Watson. The deputy Lord Mayor of Bradford (Mrs. K. Chambers) remarked that her hope was to see all houses fitted fully with electric labour-saving appliances before they were let to tenants.

The new South-West Middlesex branch held its first meeting, subsequent to the inaugural meeting, on December 12th at the electricity showrooms of the Heston and Isleworth Urban District Council. The members and guests listened to a lucid explanation of the workings of electric cookers propounded by Miss Eaves, hon. secretary, and watched demonstrations of washing machines by Miss James. Other features of the meeting were a brief explanation of the objects of the Association by Mrs. Eva M. Seward (chairman of the Branch Committee), and a short talk on cables and wiring by Miss Eaves.

Electricity Importation.

Our French contemporary, *Revue Générale de l'Electricité*, in its issue of November 8th last, gives a summary of an important article from the pen of Herr Ernst Schonholzer which recently appeared in the *Schwizrische Technische Zeitschrift*, in which the remarkable statement is made that it would be cheaper for England to scrap all its electricity generating stations and to draw its supplies of power from Continental hydro-electric power plant. The author begins with a statement that his proposal is to substitute everywhere in Europe hydro-electric for steam-generated power and so reduce the consumption of coal in Europe which, taking the year 1927 as an example, he states, occasioned a loss in steam-operated electricity stations of no less than 280 million tons of fuel, or 45 per cent. of the total European production. To avoid this increasing loss Herr Schonholzer considers that there should be established an international hydro-electric generating and distributing system capable of supplying annually 50,000 million kWh. Although this total would represent only about 8 per cent. of the power generated in Europe from coal, estimated at 615,500 million kWh for 1927, he considers that the resulting economy would be so great that the cost of his suggested European hydro-electric power station and distributing system, estimated at 1,000 million sterling, could be entirely recovered in twenty years, without taking into account the added revenue derived from coal, which, no longer used directly for steam-raising purposes, but subjected to new methods of utilisation, would realise from 15 to 20 times its present value. Herr Schonholzer proposes that London, Paris, Berlin, and Vienna, the four chief centres of power consumption in Europe, should be connected together by a 660,000-V transmission system, which would be supplied with power from hydro-electric plant in the north, south, east, and west of Europe. It is interesting to note that, while the author considers it impossible to estimate the economies and advantages which would result from such a scheme, he admits that there are many difficulties to be overcome. He appears, however, to have devoted some attention to the question of power transmission across the sea, as, for example, between Sweden and Denmark, as also between the Continent and England, his suggestion for the latter being the construction of two parallel dams across the Channel, between Calais and Deal, on which masts for two sets of transmission lines would be erected. In connection with his suggestion that England would find it cheaper to "import" its electrical power from the Continent, Herr Schonholzer states that in 1927 some 570 English steam-operated power stations consumed 7¾ million tons of coal with an average efficiency of only 11½ per cent., without taking into account the waste of money in raising and transporting this large quantity of fuel, having regard to the low rate of efficiency of its utilisation. Repeating his assertion that, whereas formerly best coal was only worth about 25s. per ton, it is now, in view of modern methods of treatment, worth much more than that sum, he further asserts that every ten million tons of coal "wasted" in direct steam and power generation means a loss of from 180 to 240 millions sterling of money.

"Electrical Geyser Explodes."

Under the above heading, a London daily newspaper published on December 12th an account of the damage caused by the explosion of an electric water heater in Bedford. The makers of the apparatus, Sadia, Ltd., had an opportunity of inspecting the premises and the heater within a few hours of the occurrence, and the following notes are taken from their report of the investigation. The equipment was an 11-gal. heater loaded at 800 W. It was supplied on hire by the Bedford Electricity Department, but was erected by a local plumber, the installation being carried out in April last. The lay-out of the job was not in accordance with the makers' general instructions or diagrams, and they had no knowledge of the actual case until after the occurrence. The hot-water taps for the bath, wash basin, and kitchen sink were supplied from the heater, which was mounted in the bathroom, near the bath. The cold-water feed was taken direct from the town water main through a non-return valve, no ball tank being installed. A safety valve was fitted by the plumber to the top of the heater immediately over the hot-water outlet, the waste pipe from the safety valve discharging into the small lavatory cistern. The installation worked to the satisfaction of the consumer until December 8th, when he reported to the supply undertaking that the heater was leaking, and the undertaking substituted for the original heater another "Sadia" on December 9th, the pipework not being interfered with. At the time the change was made the thermostat from the first heater was checked and found to switch off at the correct temperature, 195 deg. F., and it was then put into the new heater. The next day the consumer complained that the water did not appear to be as hot as usual, and an electrician was sent out by the supply authority to investigate the matter. On checking the water temperature at one of the taps, a reading of 116 deg. F. was obtained. It is very probable that, owing to the absence of hot water during the preceding day, a much greater demand arose, with the result that the capacity of the heater was overtaxed. Apparently not understanding that a casual temperature reading at the tap was no indication as to the cut-off setting on the thermostat, the electrician broke the thermostat seal and turned the adjustment up several notches, thereby preventing the thermostat switching off except at a temperature which could only be reached when the water was at a pressure far in excess of that for which the heater was designed and tested.

The plumbing arrangements were incorrect from the start, and the safety valve should have been placed either on the cold-water inlet side of the apparatus or at least eight feet away from the heater on the expansion waste pipe, according to the makers' instructions. Examination of the valve showed that it had furred up, and therefore had ceased to allow the expansion to escape, the cause of the leak on the first heater. Although the second heater would ultimately have leaked also, due to the very high water pressure generated during unrelieved expansion, no explosion would have occurred if the thermostat had not been set too high, as the expansion would have been limited to about 3 per cent., and the water would not have reached boiling point. As it happened, however, the current was not switched off, and pressure was therefore continuously built up until the water reached such a temperature that as soon as a leak developed and the pressure was relieved a large part of the water instantly turned into steam, resulting in the explosion, which not only completely destroyed the heater, but projected parts of it through the roof. The damage done to the premises was very considerable, and there is no doubt that a very great force was generated.

The makers point out that they have always recommended the use of ball-tank installations in preference to direct main connections with safety valves, because the latter are liable to be misused or badly adjusted—in spite of the printed instructions. Moreover, the Metropolitan Water Board and the large water authorities insist on *all* water-heating apparatus being fed through ball-tanks. In this they are supported by the Model Rules of the Ministry of Health. Further, the provision of a ball tank and simple open expansion pipe is often cheaper than the installation of valves. The present case of explosion is the only one out of over 10,000 "Sadia" heaters sold in this country.

Technical and Administrative Duties.

An interesting study covering many practical phases of engineering employment has been recently completed. Although it was undertaken by, and was largely for the use of, teachers of engineering, through the Society for the Promotion of Engineering Education, it has implications of interest to all engineers.

It is reported in *Civil Engineering* that one phase of this study had to do with the varying functional classification of

employment throughout the average engineer's life. The result of the investigation of engineering education indicates the average experience of about 7,000 men whose length of practice at the time the study was made, 1925-1926, varied from 1 to 40 years.

Assuming that this experience is representative, many changes may be expected as the average engineer grows older. For example, if he starts out in technical or construction work it is about a 6 to 1 chance that he will find himself in some other branch after 15 years or more.

Perhaps the most remarkable tendency revealed by the study will be found by dividing the classes of work into two broad generalisations, which for convenience have been denominated "technical" and "administrative." About 7 out of every 10 juniors immediately find themselves in technical employment, and only 3 in administrative or similar work, but not for long. Progressively the technical fields lose their men to the administrative side. After about 10 years this trend becomes somewhat stabilised, and soon the proportions are almost exactly reversed. The averages are still 7 to 3, but the popular field is now administrative.

Forging by Electric Heat.

At the Ford Motor Company's Rouge plant 55 electric furnaces are installed, according to the *Electrical World*. Temperatures necessary for forging steel vary from 1,900 to 2,450 deg. F. Most of the work in the Ford plant is heated to 2,300 to 2,350 deg. This range lies between the maximum of about 1,900 deg. F. for the commercial metallic-resistor type and the lowest practicable operating temperature of the arc furnace. In this intermediate range the carbon trough resistance furnace was first developed, and a number of these is in use in the Ford plant.

The carbon trough furnace is adequate and economical in large installations that are run continuously for long periods; it has disabilities that make it undesirable in the smaller units that are necessary in automotive production lines. The carbon furnace is a low-voltage device, and each unit must have a transformer; it requires from ten to twelve hours to reach forging temperatures; thus, for small units in more or less intermittent operation, both the first cost and the operating cost are fairly high.

Therefore, when the rod resistor, operating at surface temperatures up to 2,450 deg. F., was developed it apparently found a field ready and waiting for it. These rods are of silicon carbide, to which is added in manufacture certain other materials to act as a binder and to provide the desired conductivity. Since the rods are designed to be worked at ordinary utilisation voltages, the need for a transformer at each furnace was removed, and because of their small mass the heating-up period was reduced to much less than an hour. For these reasons the rod resistor furnace is superseding the carbon trough type for ordinary forging operations. Most of these furnaces in the Rouge plant are rated at 337 kW, 220 volts, three-phase. In each are nine groups of three star-connected rods. There are two control sections, one rated at 187 kW and containing five of the stars, and the other at 150 kW containing four. Control is effected by cutting the sections in and out.

Other furnaces of this type in the Ford installation run up to 540 kW, but the general features of design and control are the same for all of them. The size of these furnaces, most of them 5 ft. 6 in. by 2 ft. in plan, is an important consideration in this, as in any other mass-production installation. The floor area required for the electric furnace is about half that necessary for an oil- or gas-fired unit.

The 337-kW furnaces have each a capacity of 900 lb. of metal brought up to 2,350 deg. F. per hour. It is difficult to make any exact statement of performance economy, but a reasonable average figure would be in the neighbourhood of 4.75 lb. per kWh for bar heating. Three units rated at 540 kW used for heating flat-bar stock, which is bent and welded into blanks for ring gears, have each a capacity of 150 bars per hour. The bars each weigh 13.4 lb.

Electricity in Mines.

The report for 1929 of Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, can be obtained (9d., by post 10d.) from any bookseller or directly from H.M. Stationery Office.

Progress in electrical development at mines under the Coal Mines Act is analysed in detail. Electricity was used at 1,456 mines out of a total of 2,419, and the horse power of motors installed at June 30th, 1929, was 1,753,704, or 31,000 horse power more than at December 31st, 1928.

The statistical tables include a regional analysis of the horse power of motors installed, showing the extent to which direct current and alternating current, respectively, are used, and giving analyses (with comparative figures for 10 years) of fatal accidents, classified according to the type of accident, the sphere of employment of the persons killed, and the nature of the equipment involved.

There were 11 fatal accidents attributable to the use of electricity during 1929. The Inspector gives an account of these and makes comments and suggestions with a view to preventing accidents of a similar nature in future. A number of the non-fatal accidents and dangerous occurrences of an unusual nature are also described. Tables are included showing the numbers of fatal and non-fatal electrical accidents involving trailing cables and plugs which have occurred during the past five years, and a classification of all such accidents for the years 1928 and 1929.

In regard to coal-cutting machines, general analyses of the number and description of machines in use at coal mines during the last ten years are given, together with regional analyses of the quantities of machine-cut coal and other mineral cut by electricity and by compressed air. The report also includes a regional analysis comparing the numbers of conveyors and loaders driven electrically and those driven by compressed air, for the year 1929.

Included in the appendices to the report are (1) notes (with diagrams) on a method of providing for the periodic advance of gate-end switches, and (2) some notes on the danger from live electrical conductors during examination, test or repair, together with diagrams to illustrate the precautions necessary with respect to typical circuits and classes of switchgear.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Lord Inverforth has retired from the Management Committee of Imperial and International Communications, Ltd., but remains a director of that company, Marconi's Wireless Telegraph Co., Ltd., and other subsidiary companies, and president of Cables & Wireless, Ltd.

Mr. A. W. Swan informs us that he is resigning his position as publicity manager to Messrs. Evershed & Vignoles, Ltd., at the end of this month to take up a similar position with another engineering firm.

Mr. F. G. Leigh, who has been for 10 years chief engineer at Dorman Long's Bowburn, Brawney, Page Bank, and Sursdale Collieries, has taken up a position with the County of Durham Electric Power Supply Co.

Mr. Chegwidden, senior charge engineer, has been appointed combustion engineer by the Croydon Corporation Electricity Committee at his present salary of £376 per annum.

Mr. E. Eynon, sub-station inspector in the Walsall Electricity Supply Department, was recently presented by the Mayor of Walsall, on behalf of the staff and employés, with a gold hunter watch and a framed photograph of the staff to mark his completion of 25 years' service in the Department.

Mr. A. Rodwell has been confirmed in the position of general manager of the Johannesburg Electricity Department by the City Council, following the usual probationary period. His salary will be £2,000 per annum plus "locomotion allowance" of £17 10s. a month.

Mr. L. M. Barry, assistant tramway manager,, has been appointed manager of the Johannesburg Municipal Tramway Department at a salary of £1,550 per annum, plus "locomotion allowance" of £17 10s. per month. The appointment is subject to his serving a probationary period of six months at his present salary. Mr. Barry has been in the service of the Council for twenty-six years.

Mr. F. W. Martin was elected president of the Birmingham Electric Club at the recent annual meeting, and **Mr. F. C. Hall** was appointed hon. treasurer.

Mr. Alfred Doxey was presented last week with a mahogany sectional book-case upon his retirement after 46 years' service with the Sheffield Electric Supply Department and its predecessors. The presentation was made by Mr. E. Morgan, the city electrical engineer.

Mr. George E. Riley was the guest of honour at the annual dinner of the switchgear organisation of the British Thomson-Houston Co., Ltd., recently held at the Clarendon Restaurant, Hammersmith. Mr. Riley, who has been associated with the Switchgear Department for many years, and has occupied the position of commercial manager for some time, has just completed 25 years in the service of the company, and some 250 guests, including a number of the directors, assembled to congratulate him on his long and successful career and to wish

him an equally happy future. Mr. Riley, who is well known to most municipal and company engineers in this country, was

Elliott & Fry **Mr. G. E. Riley,** [*London.*

Commercial Manager of the B.T.-H. Switchgear Department.

presented with a grandfather clock, and an appropriate gift was provided for Mrs. Riley.

Obituary.

Lord Melchett.—We regret to record the death, on December 27th, of Lord Melchett, at the age of 62. Lord Melchett was the son of Dr. Ludwig Mond, F.R.S., who, with Sir John T. Brunner, founded, in 1873, the firm of Brunner, Mond and Co., which became one of the largest chemical manufacturing concerns in the world, and acquired in due course the Castner-Kellner Alkali Co. and the Electro-Bleach and By-Products Co. The amalgamation formed the basis of the colossal Imperial Chemical Industries, Ltd., which Lord Melchett organised in 1926, becoming first chairman. Another large combination for which he was responsible was the Amalgamated Anthracite Collieries, Ltd. His experience of the organisation of industries on a large scale led him to the conclusion that a certain measure of consultation with the employés was essential. As a result he called together representatives of employers and trade unions, and with the assistance of Mr. Ben Turner, then president of the General Council of the Trades Union Congress, formed the Conference on Industrial Reorganisation and Industrial Relations. For a few years he took a prominent part in politics, and was First Commissioner of Works from 1916 to 1921, and then Minister of Health until 1922.

Lord Melchett was a Fellow of the Royal Society; a D.Sc. of Oxford and Paris; founder-president of the Institute of Fuel; and president of the 1928 Sectional Meeting of the World Power Conference. He was raised to the peerage in 1928, and he is succeeded by his son, the Hon. Henry Mond, M.P.

Mr. J. P. MacTaggart.—We regret to announce the death on December 16th of Mr. John Pettie MacTaggart, who was for many years manager of the Cardiff branch office of the English Electric Co., Ltd. The funeral took place at Penarth on December 18th, and was attended by Mr. P. H. Symonds on behalf of the company. Mr. MacTaggart was born in Edinburgh in 1875, and was the third son of William MacTaggart, the artist. He was educated and served his apprenticeship in his native city, and joined Siemens Bros. & Co., Ltd., of Woolwich, in 1896. From there he went to the Newcastle office of the company, and after a short time was appointed manager of the Cardiff office. Mr. MacTaggart was very well known in South Wales, and was a prominent member and past captain of the Glamorganshire Golf Club. He was also a very keen member of the Penarth Yacht Club.

Mr. A. E. Downer.—We learn with regret that Mr. A. E. Downer, F.S.A.A., chairman and managing director of the Dermatine Co., Ltd., passed away on December 9th. He had been associated with the company for over 15 years and was appointed chairman and managing director in 1929.

Sir John Henry.—The death occurred on December 23rd, at the age of 72, of Sir John Henry, D.L., J.P., a director of a number of companies, including the Charing Cross Electricity Supply Co., Ltd.

Will.—The late **Mr. Alexander Simpson,** a director of the Cawnpore Electric Supply Corporation, Ltd., left estate valued at £39,261 (net personalty £38,635).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Aston-Lis Self-Restoring Battery Co., Ltd.—Private company. Registered December 17th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, &c. The permanent directors are:—W. H. Aston, 6, Buckingham Avenue, Whetstone, N.20; H. W. Aston, 23, Courtfield Road, Kensington, S.W.7 Registered office: 31, Eagle Wharf Road, N.1.

Battery Manufacturers' Merchants, Ltd.—Private company. Registered December 12th. Capital, £100 in £1 shares. Objects: To buy and sell commodities for use in the manufacture of dry batteries, &c. The directors are: Miss L. E. May, 12, Sussex Street, Poplar, E.14; T. R. Mennie (chairman), 18, Sabbarton Street, Poplar, E.14, traveller; Dr. G. E. Fisher, address not stated. Secretary: Alice M. Sturgess, 41, Mellish Street, Millwall, E.14.

Askrigg and Reeth Electric Supply Co., Ltd.—Registered as a public company December 22nd. Capital, £7,000 in £1 shares. Objects: To acquire the benefits of the Askrigg and Reeth Electricity Special Order, 1929, in favour of W. H. Burton, E. Burton, and W. Burton, authorising the supply of electricity for public or private purposes within Askrigg and Low Abbotside, in the rural district of Aysgarth (except the lands common to High Abbotside and Low Abbotside), so much of Bainbridge in the said rural district as lies between the River Bain and the Askrigg to Bainbridge Road and within a distance of 200 yards from the centre line of the River Ure; and the townships of Reeth and Grinton, all in Yorkshire, together with certain real and personal property and assets belonging to W. H. Burton and used in connection with generating, accumulating, distributing and supplying electricity within the said area. The first directors are: W. H. Burton, The Lodge, Askrigg, Yorks.; E. Burton, West Mill, Askrigg, Yorks.; W. Burton, Croft House, Askrigg, Yorks., engineers. Solicitor: Arthur H. Wilkinson, Leyburn.

Pipe & Cable Installations, Ltd.—Private company. Registered December 20th. Capital, £10,000 in £1 shares. Objects: To carry on the business of engineers and contractors for the projecting, supply and erection or laying of tubes, pipes, ducts, channels and all means and ways of conveying liquids, gas, air, sewage and steam, and cables and wires for the conveyance of electric power, &c. The first directors are: L. B. Mortlock, 139, Overhill Road, Dulwich, S.E., merchant (director of Asbestos Manufacturers, Ltd.); K. Reed, 2, Courtside, Sydenham, S.E.26, manager. Registered office: 47, Victoria Street, S.W.1.

British Luminators, Ltd.—Private company. Registered December 20th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and importers of and dealers in all kinds of electrical, oil and other illuminations, accumulators, lamps, apparatus and devices for light, heat, motive power, &c. The directors are: F. Turner, 8, John Street, Mayfair, W. (director British Visada, Ltd.); S. N. de Y. Bateson, "Dormers," Bovingdon, Herts.; G. H. F. Knight, 48, Pont Street, Mayfair, W. Solicitors: Mackrell, Ward & Knight, 33, Walbrook, E.C.4.

Welding Rods, Ltd.—Private company. Registered December 19th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement between J. H. Aitchison, H. Bull and L. Johnson; and to carry on the business of manufacturers of electrodes for welding, &c. The directors are: H. Brearley, "Walton," Mead Road, Torquay; J. H. Aitchison, 17, Stone Delf, Fulwood, Sheffield; H. Bull, 32, The Grove, Heatherfield, Totley, nr. Sheffield; L. Johnson, 1, Denbank Avenue, Sandygate, Sheffield; all metallurgists. Registered office: 186, Attercliffe Road, Sheffield.

Spa Electrical Specialties, Ltd.—Private company. Registered December 19th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, mechanical, wireless, telephone, lighting, heating, motor and general engineers, &c. The provisional directors are: L. W. Parkes, 62, Manor Road, Mitcham, clerk; Miss E. Boanas, 22, Graham Road, Mitcham, typist. Secretary: H. T. Bryan.

Battery Components, Ltd.—Private company. Registered December 15th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and repairers of batteries and magnetos, woodworkers and cabinet makers, electrical engineers, iron and brass founders, &c. The subscribers (each with one share) are: H. J. Edwards, electrical engineer, and Mrs. L. M. Edwards, 113, Arthur Street, Chelsea, S.W. H. J. Edwards is the first director. Registered office: 13, High Road, Ilford.

Official Returns of Electrical Companies.

Lancashire Telephone Systems, Ltd.—Issue on January 10th of £100 and on July 23rd, 1930, of £250 debentures, parts of a series already registered. (Notice of issues filed December 12th.)

Electrolumination (Abadie Process), Ltd.—Particulars filed of debentures for sums not exceeding £5,000 at any one time authorised October 8th, 1930, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,700.

Satisfaction to the extent of £1,200 on October 29th, 1930, of debentures authorised August 2nd, 1929, and registered August 20th, 1929. According to the register of mortgages, the debentures registered August 20th, 1929, originally secured £2,000.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £1,879 on December 9th, 1930, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgment dated June 12th, 1907, and registered July 11th, 1905, and June 20th, 1907, respectively.

Maintenance Contracts, Ltd.—Debenture dated December 3rd, 1930, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. J. Gregory, 2, Oakfield Road, N.4.

Pickvance, Ltd.—A. Moffat, The Priory, Priory Street, Wrexham, was appointed receiver and manager on December 4th, 1930, under powers contained in debentures dated July 10th and October 11th, 1924.

Brown & Co. (Electrical Engineers), Ltd.—Capital, £5,000 in £1 shares. Return dated October 8th, 1930. 4,529 shares taken up. £12 paid. £4,517 considered as paid. Mortgages and charges, nil.

Meifod Electricity Co., Ltd.—Capital, £100 in 5s. shares. Return dated June 13th, 1930. 37 shares issued and fully paid up. Mortgages and charges, £1,300.

Power Producers, Ltd.—Capital, £12,500 in £1 shares. Return dated October 21st, 1930. All shares taken up. £3,125 (5s. per share) paid. Mortgages and charges, nil.

Robinson & Hands Electric Co., Ltd.—Capital, £5,000 in 20 ordinary and 4,980 preference shares of £1. Return dated November 7th, 1930. 20 ordinary and 4,232 preference shares taken up. £4,252 paid. Mortgages and charges, nil.

National Accumulator Co., Ltd.—Capital, £350,000 in 175,000 preferred ordinary and 175,000 deferred ordinary shares of £1 each. Return dated July 29th, 1930. All shares taken up. £292,616 paid. £57,384 considered as paid. Mortgages and charges, nil.

Killamarsh and District Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares. Return dated September 10th, 1930. £3,235 shares taken up. £3,235 paid. Mortgages and charges, nil. Return of allotments, made up to October 27th, 1930, shows a further 395 ordinary shares allotted, payable in cash and fully called up.

Neolight Signs Co., Ltd.—Capital, £1,000 in £5 shares. Return dated May 5th (filed November 5th), 1930. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Holderness Trust, Ltd.—Capital, £5,000 in £1 shares. Return dated July 3rd, 1930. All shares taken up. £900 (6s. per share) paid. Mortgages and charges, nil.

Abbey Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated August 5th, 1930. 390 shares taken up. £390 paid. Mortgages and charges, nil.

Jones Bros. (Blackpool), Ltd.—Capital, £5,000 in £1 shares. Return dated October 21st, 1930. 3,070 shares taken up. £294 paid. £2,776 considered as paid. Mortgages and charges, nil.

P. Goddard & Co., Ltd.—Two notices of the appointment of C. A. Sandon, 1a, Sloane Court, S.W.3, as receiver and manager on December 15th and 16th, 1930, under powers contained in debentures dated April 25th, 1930.

A.F.M. Electrical Service, Ltd. (formerly H. H. H., Ltd.).—F. W. Miller, 187, Melrose Avenue, Cricklewood, N.W.2, was appointed receiver and manager on December 15th, under powers contained in debentures dated April 28th and August 27th, 1930.

Arctic Electric Supplies, Ltd.—Debenture dated November 28th, 1930, to secure £2,768, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. H. Ansell, 20, Northumberland Avenue, Reading.

Robert F. Hearn, Ltd.—Satisfaction to the extent of £115 on November 1st, 1930, of debentures authorised August 21st, 1930, and registered September 1st, 1930, securing £920.

Helios Electrical Co., Ltd.—Capital, £200 in £1 shares. Return dated December 31st, 1929 (filed September 25th, 1930). 20 shares taken up. £20 paid. Mortgages and charges, nil.

Autocar Electrical Equipment Co., Ltd.—Capital, £5,000 in £1 shares. Return dated August 30th (filed September 18th), 1930. 4,002 shares taken up. £4,002 paid. Mortgages and charges, nil.

Auto Electrical Service Co., Ltd.—Capital, £3,000 in £1 shares. Return dated August 30th (filed September 17th), 1930. 1,002 shares taken up. £1,002 paid. Mortgages and charges, nil.

Halsey's Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 11th (filed August 23rd), 1930. 500 shares taken up. £500 paid. Mortgages and charges, nil.

City Notes.

Baird Television, Ltd.

The annual meeting was held on December 22nd, Lord Ampthill (chairman) presiding. In presenting the report and accounts (*vide* ELECTRICAL REVIEW, December 19th, p. 1057), the chairman said that during the past few months there had been developed a large television screen suitable for receptions in theatres and it had already proved a considerable success. They were, however, engaged in constructing an improved apparatus which would give far better results and on a materially larger scale. They hoped to adopt, with the co-operation of the British Broadcasting Corporation, a further development. This was a new portable transmitter, now completed in their laboratory. With the new transmitter there was no visible light, and the person being televised was subjected to no inconvenience of that nature. They hoped soon to be demonstrating this transmitter in conjunction with the B.B.C. (with whom they were in negotiation), and also over their own aerial at Hendon. A new form of home "Televisor" had been evolved which it was hoped to have ready for manufacture during the coming year. An interesting experiment was about to be carried out in France through their friends there, *viz.*, a combined telephone and television service between Paris and Lyons, under the auspices of the Minister of Posts and Telegraphs. Considerable developments were taking place on the Continent and in America. They had received from Mr. H. J. Whitcomb, a joint liquidator with Mr. F. Rowland, of Television, Ltd., a notice of motion proposing that one of the three vacancies in the office of director be filled by the election of Mr. Rowland, and that the other two vacated offices of director be not filled. They therefore proposed to adjourn the meeting until a convenient day in January in order that shareholders not present at the meeting might be given an opportunity of expressing their views on the question of the directorate by means of proxies. The resolution to adjourn the meeting was adopted.

Burndept Wireless (1928), Ltd.

The directors' report for the year ended June 30th last shows that after providing for depreciation of plant and machinery and stocks, and making full provision for doubtful debts and special credits issued for returned apparatus, there was a loss of £21,867, from which is deducted £2,878 brought in, leaving a net loss to be carried forward of £18,989. The report states that the satisfactory volume of business obtained from the Radio Exhibition in September, 1929, was partly due to the introduction of a portable set at a popular

price and partly to a new set which was shown at the exhibition. Unfortunately, however, certain proprietary components incorporated in this and other sets and supplied by outside reputable firms gave considerable trouble, with the result that many outstanding orders were cancelled, and a large number of sets were returned for service and repair, and, although in due course these were fitted with improved and satisfactory parts, a certain amount of prejudice against the company's main selling lines had been created. These difficulties resulted in an accumulation of stock. The performance of the range of models produced by the company since last season is highly spoken of, both by the trade and the public, and the design has enabled the company to avoid the troubles and return of sets from which it suffered during the earlier period. The new screened "portable de luxe" set and the "Universal Five" series have been well received in the home market and are selling in many overseas countries. The report records the resignation in October last of Col. A. Simpson from the board, as his position as managing director clashed with his work as a director of another company. At the adjourned annual meeting held on December 30th is was decided, on the motion of a shareholder, that a committee of three shareholders should be set up to confer with the board, and that the meeting should be further adjourned to a date to be agreed upon by the committee.

South Wales Power Co.

A provisional agreement has been entered into whereby the Shropshire, Worcestershire and Staffordshire Electric Power Co. will purchase the whole of the assets of the company for a total sum of £1,265,000, and an extraordinary meeting of shareholders is to be held to-day (Friday) to confirm the agreement. The effect of this will be that the Shropshire Company will become the owners of the South Wales Electrical Power Distribution Co. According to the *Western Mail*, the present directors of the latter company will retire, and a new board will be nominated by the purchasing company, but Mr. W. North Lewis has been invited to continue as chairman.

Ceará Tramway Light & Power Co., Ltd.

The annual meeting was held on December 23rd, Mr. E. H. R. Trenow (chairman) presiding. In presenting the report and accounts, the chairman said that the advance in net revenue constituted a record. This improvement, however, had not been common to all sections of the business, and the credit for the net gain must be attributed to the power and light department. The generating plant was now nearing its greatest possible output, and they were meeting the anticipated expansion in business by the provision of a new 2,000-kW turbo-generator. The plant had arrived in Ceará and when installed should be effective in reducing the present cost of production. The report and accounts were adopted.

John Shaw & Sons, Wolverhampton, Ltd.

The net profit for the year ended June 30th last was £5,441, as compared with £5,833 in the previous year, which with £31,553 brought in makes £36,994 available. The preference dividend is paid, and £29,644 is carried forward. The directors have agreed, as from January 1st, 1930, for the time being, to a reduction in remuneration, which will result in an economy of £600 per annum, and as from December 1st, 1930, to a reduction in their fees as directors of James F. Low and Co.

Bullers, Ltd.

The trading profit to July 31st last was £23,793, as compared with £22,458 in the preceding year. The report states that since the closing of the accounts the volume of business has been materially affected by prevailing conditions of trade, and it is proposed therefore to transfer £10,000 to reserve, with the object of consolidating the position to meet the present period of depression, and to carry forward £4,362.

Tube Investments, Ltd.

At an extraordinary meeting held on December 30th the increasing of the capital from £2,723,268 to £2,973,268 by the creation of 250,000 new shares of £1 each was approved. The new capital is required to meet ordinary requirements arising out of the natural development of the company's business and there will be no public issue, or issue to the shareholders.

Ruths Steam Storage, Ltd.

The operations for the year ended August 31st last resulted in a loss of £25,855, as compared with a loss of £45,068 in the previous year. The board is at present engaged in negotiations, which, it is anticipated, will result in an offer being made in respect of the "A" shares.

Altrincham Electric Supply, Ltd.

An interim dividend of 3s. 9 3/5d. per ordinary share and 1s. 3 6/7d. per deferred share has been announced.

Greenwood & Batley, Ltd.

An interim dividend is announced of 2½ per cent.

Stocks and Shares.

TUESDAY EVENING.

WHY the implementing of a sense of duty should almost invariably be unpleasant for everyone concerned is a matter for the psychologist rather than for the financial writer called upon to deal with annual tables of comparative prices in this present year of grace. Stock Exchange values, like commodity and metal quotations, show lugubrious lists of losses with, however, brilliant exceptions. Chief amongst these latter are the securities commonly termed gilt-edged, amongst which the British Government issues are particularly prominent. The Bank Rate has come down from 5 per cent. to 3 per cent. Trade has been disappointing in most parts of the world. Politics have done nothing to encourage public confidence. These are some of the reasons that made for the forcing of capital into the purely Safety First stocks. This has turned to the advantage of the Central Electricity Board and other bodies that offered unimpeachable security of the type for which public appetite has eagerly asked. The prices are substantially better, and the reflection of this tendency is marked in the group of electricity supply shares. It is somewhat singular that two of the markets with which these weekly notes are associated should exhibit improvements in a year when so many other departments of the Stock Exchange have suffered heavy losses. The record of the London electricity supply companies is eminently satisfactory to shareholders, as this table demonstrates:—

Ordinary shares.	December, 1928.	December, 1929.	Now.	Rise on year.
Brompton	27/0	25/6	27/6	2/0
Charing Cross ...	26/6	26/0	29/0	3/0
Chelsea	27/0	25/0	27/6	2/6
City of London ...	30/9	32/0	36/3	4/3
County	44/6	42/6	47/6	5/0
Kensington	26/6	26/0	27/6	1/6
London	26/0	26/0	32/6	6/6
Metropolitan	46/3	37/6	42/0	4/6
St. James'	27/6	26/0	28/0	2/0
South London ...	27/6	25/6	27/0	1/6
Westminster	27/0	25/0	29/0	4/0

American Crises.

In 1929, it was the Hatry crash which stood out as the principal feature that caused depression throughout the Stock Exchange markets. The year which is now ending, 1930, will be remembered as one in which deflation occurred in practically everything except, as previously mentioned, the gilt-edged and investment securities. This deflation affected the United States even more than this country. The New York Stock Exchange has suffered a series of minor shocks which, if they cannot be called crises, had a devastating influence upon quotations, and went far to cause the losses whose reflection is still felt on this side of the Atlantic. The main falls are those which have occurred in American stocks and shares, utilities principally, in which the market is more or less local to the States. But a record of 1930 changes would be incomplete without some slight reference to the extent of the falls which have occurred, and of which some faint idea can be gathered by reference to the following group. Brazilian and Mexican issues have been included, because these have felt the force of the American liquidation which extended to all dollar stocks. Brazil has had troubles peculiar to herself, and, like the Argentine Republic, suffered a mild revolution. The exchanges fell heavily, and prices of South American as well as United States shares have gone back materially. The following examples give a little idea of the damage which the fall has caused:—

Stock or share.	1929. January 2nd.	December 31st.	Now.	Fall on year.
American Telephone and Telegraph ...	197½	225	182½	42½
Brazilian Tractions ...	78½	38	21	17
Calgary Power	160	160	152	8
Int. Telephone and Telegraph	202½	75*	20¼	54½
Mexican Light & Power	77½	75	42½	32½
Mexico Tramways ...	47½	30	10	20
Shawinigan	90	77½	52	25½

* Three new shares were exchanged for one old share.

Anglo-Argentine Tramways first preference have fallen from £3 to 27s. 6d., on the passing of the dividend.

Tube Railway Stocks.

The market in the stocks and shares of the electrically-operated railways of this country is amongst the very few which stand out with improvements on the year. While the prices of the steam stocks are heavily down, those in the Underground group exhibit noteworthy strength. The principal rise is one of 8 points in Central London assented ordinary stock. Although the market suffered an unpleasant shock by the announcement that the Government intends to set up a Board to control London traffic, the weakness which occurred on this statement was followed by a recovery in prices. Rumour has revolved rapidly around the prospects of the Metropolitan

Railway being included in the traffic combine, and at one time it seemed as though the absorption was on the point of being consummated. It happened, however, that the Government's proposals were made public at this particular juncture, with the result that amalgamation talk has faded into the background, though the expectation is still alive in regard to the complete unification of the Circle at some not very distant date. The following table indicates the movements in these shares.

Stock or share.	December 1928.	December 1929.	Now.	Rise on year.
Central London ordinary	73	71	79	8
Metropolitan	65	62½	68½	6
District	80½	72	77	5
Underground shares ...	26/6	21/6	24/6	3/0
Underground Income ...	126	104	104	—

Cables and Wireless.

It is when we come to the list of stocks and shares in the cable market that the principal falls are uncovered, so far as these concern British stocks and shares. Cables & Wireless "A" stock has shed 53 points, and the company's preference and "B" ordinary stocks 26 points apiece. To make matters worse, these falls, it must be remembered, came on the top of heavy shrinkages in the previous six months. The "B" stock has dropped from its previous high estate of 90 to a mean 11¼, and the "A" stock, which touched three figures, is down to 22½ The reasons can be explained in a couple of sentences: the first is depression of trade throughout the world; the second, the refusal of the British Post Office to assist the Imperial Company. Earnings have fallen in startling fashion, and there is some doubt whether the dividend on the preference stock can be maintained, although the payment which is due next March is considered to be reasonably safe. The price of the preference stock—70—indicates the uneasiness felt in regard to the position. A fall of no less than £10 per share has taken place in Globe ordinary, this being a direct reflection of the slump in Cables & Wireless stocks, added to which there is the certainty that the company cannot continue to pay the 10 per cent., free of tax, dividends that have been distributed for years past. Anglo-American Telegraph preferred stock is better, thanks to the demand there has been for investment securities of all kinds. Great Northerns have managed to shake themselves free from the malinfluence that has attacked cable stocks as a whole. The following table gives the salient features:—

Stock or share.	December 1928.	December 1929.	Now.	Rise or fall this year.
Anglo-American pref. ...	103½	101½	103½	+ 2
Globe ordinary	25½	23	13	− 10
Great Northern ...	34½	29⅜	30	+ ½
Marconi Marines	3 9/16	2¼	38/9	− 6/3
Cables & Wireless pref.	—	96	70	− 26
Cables & Wireless "A"	—	75½	22½	− 53
Cables & Wireless "B"	—	37½	11¼	− 26

Manufacturing and Equipment.

The catalogue of stocks and shares in the group of manufacturing and equipment shares presents a string of falls. The only exception in our list is Johnson & Phillips, the price of whose shares has risen 6d. to 36s. 9d. The principal proportionate fall is one of 6½ in Telegraph Construction shares, followed by a drop of 21 points in Brush ordinary stock. G.E.C. ordinary have escaped very lightly, but shares in the iron, steel, and allied group, of which Babcock & Wilcox make a representative example, are down on the year. A list of a dozen will suffice to reflect the tendency of the year's movements:—

Share.	December. 1928.	1929.	Now.	Fall on year.
Associated Electrical Ind. ...	—	23/9	20/6	3/3
Babcock	3½	60/9	49/6	9/16
British Aluminium	2½	46/0	30/6	15/6
British Insulated	4½	3 13/16	3¾	7/16
Brush	1 7/16	126	105	21
Callender's	4 1/16	3⅜	3¼	⅛
Enfield Cables	5½	4⅞	4 5/16	9/16
G.E.C.	43/9	46/3	43/9	¼
Henley's	5¾	5 15/16	5⅞	1/16
India-Rubber	11/3	11/3	6/3	5/0
Siemens	26/3	31/3	21/3	10/0
Telegraph Construction ...	25	23	16½	6½
Johnson & Phillips	36/3	36/3	36/9	+6d.

It is not unfair to assume that such a year is hardly likely to recur for a long time to come, and one may say that the fall has left prices standing upon levels from which there is ample scope for improvement as soon as industry throughout the world begins to show signs of increasing vitality. From the financial point of view, the groups of electrical stocks and shares have emerged from 1930 exceptionally well. If the present prospect is far from being as clear as most people would like it to be, evidence is not wanting that abundance of capital is locked up temporarily in gilt-edged stocks, capital that can be relied upon to return into industry directly there is a marked change in the position of the world's trade.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Approx. Dividend. 1928.	1929.	Price Dec. 30 1930.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	15	15	3⅛	—	4 17 10
Brompton Ordinary	1	8½	8½	27/6	—	5 1 10
Charing Cross Ordinary ...	1	8½	8½	29/-	—	4 16 7
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8¾	8¾	27/6	—	5 1 10
City of London	1	10	10	36/3	—	5 10 3
do. do. 6% Pref. ...	1	6	6	24/6	—	4 18 0
Clyde Valley	1	8	8	34/6	—	4 12 9
County of London	1	7	10	47/6	—	4 4 2
do. do. 6% Pref. ...	1	6	6	24/-	—	4 18 0
Edmundsons' 7% Pref. ...	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation ...	1	11	11	48/9	—	4 10 0
Kensington Ordinary ...	1	8	8	27/6	—	5 1 10
Lancs. Light and Power ...	1	7½	7	25/-	—	5 12 0
London Electric	1	8½	9	32/6	—	5 10 9
Metropolitan	1	9	10	42/-	—	4 15 3
do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Midland Counties	1	6½	7	28/6	—	4 18 3
Mid. Elec. Power	1	15	8	31/3	—	5 2 5
Newcastle-on-Tyne Ordinary ...	1	6	6	24/6	—	4 18 0
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref. ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall ...	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	29/6	—	5 8 6
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	29/6	—	4 15 0
Westminster Ordinary	1	8½	8½	29/-	—	4 16 7
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	34/6	—	4 12 9

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	79	—	5 0 9
Metropolitan	,,	3½	4	68½	—	5 16 10
do. District	,,	4	5	77	—	6 9 10
Underground Electric	£1	7	8	24/6	—	6 10 8
do. do. Income ...	Bonds	6	6	104	—	5 15 7

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 7
do. Def.	,,	1½	1½	26¾	—	5 14 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	—	5½	70	—½	7 17 2
do. A 7½% Ord.	,,	—	—	22½	—	... ...
do. B Ord.	,,	—	—	11½	—1	... ...
Globe Tel. and T. Ord.	10	10	10	13xd	—	7 13 10
do. do. Pref.	10	6	6	10½xd	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	38/9	—	7 15 0
Oriental Telephone Ord.	1	12	12	2⅝	—	*5 1 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	1⅜	—	... ...
do. do. 2nd Pref. ...	5	6	6	17/6	—	... ...
do. do. 5% Deb. ...	Stock	5	5	54½	+2	9 3 6
British Electric Traction Def. Ord.	,,	5	5	13⅜	—	... ...
do. do. Pref. Ord.	,,	8	8	131½	—	6 1 6
Brazil Traction	100	7	8	21	—1	... ...
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/6	—	... ...
London United Tram Deb. ...	Stock	4	4	53½	—	7 9 10
Mexico Trams, 5% Bonds ...	—	5	5	62	—	8 1 4
Mexican Light Common	100	Nil	Nil	42½	—	... ...
do. 7% Pref.	100	7	7	64½	—	10 17 0
do. 1st Bonds	—	5	5	80	+1	6 5 0
Victoria Falls Ord.	1	15	15	58/9	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

MANUFACTURING COMPANIES.

Assoc. Elec. Ord.	1	6	6	20/6	—	5 17 1
Babcock & Wilcox	1	13	15	49/6	—	*6 1 0
British Aluminium Ord.	1	10	10	30/6	—3d.	6 11 2
British Insulated Ord.	1	15	15	3¾	—¼	4 9 0
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3¾	—	4 16 0
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	21/3	—	7 1 2
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	92½xd	—	5 8 1
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4⅝	—	5 16 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	21/6	+6d.	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	10	14	43/9	—	6 7 9
Henley	1	25	30	5¾	—⅛	5 2 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	6/3	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 8 10
Siemens Ord.	1	7½	7½	1⅛	—	7 1 2
Telegraph Construction	12	10	10	10½	—1	*7 5 6

*Dividends paid free of Income Tax.

Electrical Exports of the United States.

Figures for 1928 and 1929 Compared.

THE following figures, showing the exports of electrical machinery and apparatus from the United States and the principal countries of destination in 1929 are taken from the recently-issued annual statistics of American trade. The comparative figures for 1928 have been added and notes of any increases or decreases given. According to the official statistics the total values in thousands of dollars of the exports of electrical machinery and apparatus since 1922 have been as follows:—1922, 53,147; 1923, 59,927; 1924, 69,828; 1925, 73,790; 1926, 84,226; 1927, 84,610; 1928, 88,956; 1929, 121,357.

	1928. Thous. $	1929. Thous. $	Inc. or dec. Thous. $
Generators, d.c., under 500 kW—			
Total	1,231	1,297	+ 66
To Great Britain	126	108	− 18
,, Canada	402	347	− 55
,, Mexico	85	153	+ 68
,, Colombia	58	34	− 24
,, Venezuela	29	28	− 1
,, China	40	50	+ 10
,, Japan	15	33	+ 18
,, Australia	29	40	+ 11
,, Cuba	38	38	—
,, Argentina	70	47	− 23
,, Brazil	27	40	+ 13
,, Russia	60	26	− 34
,, S. Africa	10	8	− 2
Generators, d.c., 500 kW and over—			
Total	624	863	+ 239
To Spain	125	14	− 111
,, Canada	38	99	+ 61
,, Cuba	48	3	− 45
,, Brazil	51	162	+ 111
,, Chile	10	76	+ 66
,, Japan	136	10	− 126
,, Mexico	36	321	+ 285
,, Argentina	41	1	− 40
,, Colombia	9	64	+ 55
Generators, a.c., under 2,000 kVA—			
Total	227	296	+ 69
To Russia	13	19	+ 6
,, Canada	82	113	+ 31
,, Mexico	18	32	+ 14
,, Colombia	—	10	+ 10
,, Philippine Islands	17	26	+ 9
Generators, a.c., 2,000 kV and over—			
Total	394	312	− 82
To Japan	122	156	+ 34
,, Canada	20	9	− 11
,, Cuba	—	36	+ 36
,, Colombia	3	27	+ 24
,, Australia	1	73	+ 72
Steam turbine generator sets—			
Total	856	1,024	+ 168
To Mexico	5	179	+ 172
,, Japan	63	259	+ 196
,, Brazil	11	50	+ 39
,, Canada	178	272	+ 94
,, Chile	1	31	+ 30
,, Dutch West Indies	—	96	+ 96
,, Argentina	33	10	− 23
,, Australia	22	8	− 14
Self-contained lighting outfits—			
Total	1,116	1,190	+ 74
To Spain	39	24	− 15
,, Great Britain	155	172	+ 17
,, Canada	139	215	+ 76
,, Mexico	51	51	—
,, Argentina	156	130	− 26
,, Colombia	31	29	− 2
,, Cuba	6	21	+ 15
,, Uruguay	13	14	+ 1
,, India	17	20	+ 3
,, Australia	132	66	− 66
,, British South Africa	68	79	+ 11
Distribution transformers less than 500 kVA—			
Total	829	1,298	+ 469
Instrument transformers—			
Total	91	155	+ 64
Power transformers 500 kVA and over—			
Total	1,197†	1,351*	+ 154
Other transformers—			
Total	893	1,450*	+ 557
Accessories and parts for generators—			
Total	1,094	980	− 114
Rectifiers, double current, and motor generators, dynamotors, synchronous and other convertors—			
Total	1,129	1,278	+ 149
To France	19	7	− 12
,, Great Britain	30	23	− 7
,, Canada	169	377	+ 208
,, Mexico	42	55	+ 13
,, Chile	39	45	+ 6
,, Japan	120	173	+ 53
,, Australia	54	52	− 2
,, Spain	191	20	− 171
,, Brazil	97	185	+ 88
Switchboard panels, except telephone—			
Total	1,619	1,183	− 436
Switches and circuit breakers over 10 amp.—			
Total	1,758	2,259	+ 501
Fuses and fuse blocks—			
Total	438	574	+ 136
Watt-hour and other measuring instruments—			
Total	994	1,266	+ 272
To Canada	105	103	− 2
,, Mexico	65	80	+ 15
,, Cuba	43	39	− 4
,, Brazil	217	289	+ 72
,, China	45	29	− 16
,, Japan	90	55	− 35
,, Australia	42	50	+ 8
Electrical indicating instruments—			
Total	453	701	+ 248
To Canada	139	195	+ 56
,, Japan	61	127	+ 66
Electrical recording instruments—			
Total	216	326	+ 110
Other electrical testing apparatus—			
Total	873	1,048	+ 175
Lightning arrestors, choke coils, &c.—			
Total	782	995	+ 213
Motors, ¼ h.p. and under—			
Total	2,122	2,699§	+ 577
Motors, under ¼ and over 1 h.p.—			
Total	835	778§	− 57
Stationary motors, 1 to 200 h.p.—			
Total	2,872	4,251	+ 1,379
To Spain	17	67	+ 50
,, Great Britain	145	151	+ 6
,, Canada	755	975	+ 220
,, Mexico	217	397	+ 180
,, Cuba	101	127	+ 26
,, Brazil	66	179	+ 113
,, Chile	101	202	+ 101
,, China	33	62	+ 29
,, Japan	116	109	− 7
,, Australia	69	67	− 2
,, British South Africa	66	65	− 1
,, Argentina	377	768	+ 391
Motors, over 200 h.p.—			
Total	387	398	+ 11
To Canada	48	50	+ 2
,, Mexico	51	59	+ 8
,, Chile	9	12	+ 3
,, Japan	14	7	− 7
,, British South Africa	17	6	− 11
,, France	7	30	+ 23
,, Cuba	32	16	− 16

* Notably to France, Canada, Mexico, Soviet Russia, Cuba, Brazil, and Chile.

† Notably to Belgium, Finland, Greece, and Australia.

	1928. Thous. $	1929. Thous. $	Inc. or dec Thous. $
Railway motors—			
Total	598	304	− 294
To Canada	39	17	− 22
,, Mexico	15	70	+ 55
,, Brazil	94	24	− 70
,, Japan	331	86	− 245
,, British South Africa	—	20	+ 20
,, Portugal	84	64	− 20
Starting and controlling equipment—			
Totals—			
For industrial motors	1,523	2,028	+ 505
For electric railway and vehicle motors	238	204	− 34
Accessories and parts for motors—			
Total	2,542	3,494	+ 952
Railway signals, switches, and attachments—			
Total	713	1,240	+ 527
To Canada	432	693	+ 261
,, Japan	36	41	+ 5
,, India	5	12	+ 7
,, Chile	1	49	+ 48
,, Australia	26	70	+ 44
,, Spain	97	90	− 7
,, Russia	‡	154	—
Insulating material—			
Total	1,349	1,495	+ 146
To France	56	60	+ 4
,, Great Britain	351	435	+ 84
,, Canada	391	450	+ 59
,, Japan	166	138	− 28
,, Australia	29	29	—
,, Italy	41	41	—
Fans—			
Total	938	1,187	+ 249
To Canada	100	200	+ 100
,, Argentina	160	212	+ 52
,, China	140	70	− 70
,, British India	24	109	+ 85
,, Australia	32	63	+ 31
,, Cuba	36	37	+ 1
,, Mexico	39	45	+ 6
,, Great Britain	22	29	+ 7
,, Japan	33	37	+ 4
,, Hong-Kong	83	45	− 38
Household washing machines	‡	2,000	—
Vacuum cleaners	1,308	1,488††	+ 180
Other motor-driven household†† devices	858	1,129	+ 271
Cooking ranges	294	354**	+ 60
Other domestic heating and cooking apparatus—			
Total	931	1,007**	+ 76
Industrial electric furnaces and ovens—			
Total	456	485	+ 29
Metal-filament lamps—			
Total	1,465	1,311	− 154
To Canada	23	23	—
,, Peru	26	34	+ 8
,, Mexico	294	100	− 194
,, Cuba	124	181	+ 57
,, China	64	12	− 52
,, Argentina	123	101	− 22
,, Brazil	28	35	+ 7
,, Australia	116	94	− 22
,, British South Africa	20	26	+ 6
,, Chile	121	114	− 7
,, Hong-Kong	66	18	− 48
Sparking plugs—			
Total	1,417	2,098	+ 681
Other ignition apparatus	1,080	1,846	+ 766
Radio B and C batteries, dry	‡	1,033	—
Insulated wire and cable, iron or steel—			
Total	217	397	+ 180
Insulated wire and cable, copper—			
Total	4,817	6,176	+ 1,359
Batteries, flashlight—			
Total	2,941	3,466	+ 525
To Mexico	115	120	+ 5
,, Argentina	351	326	− 25
,, India	354	479	+ 125
,, Philippine Islands	173	172	− 1
,, Australia	110	137	+ 27
,, Siam	53	125	+ 72
,, Hong Kong	392	368	− 24
,, Java	125	161	+ 36
,, China	167	304	+ 137
,, British Malaya	410	457	+ 47
,, Colombia	153	150	− 3
,, Venezuela	78	100	+ 22
Batteries, other primary—			
Total	2,750	1,707	− 1,043
To Great Britain	95	33	− 62
,, Canada	81	84	+ 3
,, Argentina	705	537	− 168
,, Chile	53	40	− 13
,, China	106	70	− 36
,, Australia	736	222	− 514
,, New Zealand	138	51	− 87
,, British India	20	44	+ 24
,, Brazil	51	57	+ 6
,, Mexico	36	81	+ 45
Batteries, storage—			
Total	3,401	3,475	+ 74
To Great Britain	150	65	− 85
,, Canada	266	258	− 8
,, Mexico	109	105	− 4
,, Argentina	324	380	+ 56
,, Brazil	149	102	− 47
,, India	228	304	+ 76
,, Australia	334	226	− 108
,, New Zealand	110	113	+ 3
,, South Africa	462	436	− 26
,, Chile	72	144	+ 72
Metal conduit, outlet and switch boxes—			
Total	1,331	1,549	+ 218
Telegraph apparatus—			
Total	866	1,071	+ 205
To Great Britain	52	52	—
,, Canada	369	491	+ 122
,, Japan	24	111	+ 87
,, Newfoundland	40	22	− 18
,, Germany	81	75	− 6
Radio apparatus—			
Total	12,062	23,120	+11,058
To Canada	5,264	10,783	+ 5,519
,, Argentina	431	1,775	+ 1,344
,, Brazil	1,401	550	− 851
Telephone instruments—			
Total	433	981	+ 548
Telephone switchboards—			
Total	400	1,626	+ 1,226
Telephone equipment, other—			
Total	2,495	3,961	+ 1,466
Locomotives, electric railway—			
Total	1,058	656	− 402
To Japan	123	79	− 44
,, Brazil	540	337	− 203
,, Canada	100	117	+ 17
Locomotives, electric, mining and industrial—			
Total	471	466	− 5
To Chile	241	55	− 186
,, Mexico	13	37	+ 24
,, British South Africa	19	66	+ 47
,, Canada	47	78	+ 31
,, New Zealand	32	34	+ 2

‡ Not specified.
§ Notably to France, Germany, U.K., Canada, Argentina, Brazil, and Australia.
** Mainly to Great Britain, Canada, Argentina, Australia, Mexico, and Brazil.
†† Mainly to Holland, Great Britain, Canada, and Australia.

Electroplaters' Annual Meeting.

The report of the hon. secretary of the Electroplaters' and Depositors' Technical Society on its activities during the 1930 session shows that the year under review has not been a happy one industrially, although the electrodeposition industry has probably not suffered as much as most others, due to the fact that electrodeposition enters so many other industries. At times of industrial depression usually one of the first effects is the set-back experienced by research and technical bodies, at the very time when the aid which such bodies can provide could be most profitably utilised. So far as this Society is concerned, however, steady progress has continued unimpaired in every direction, and one or two ambitious experiments tried during the session proved to be remarkably successful.

Membership has steadily increased, the number of applications received and passed being 69; nine members resigned during the session and death claimed two. The attendance at meetings has been satisfactory; ten ordinary and one special meetings were held, at which eleven papers were presented.

The *Journal* is assuming more imposing proportions and the abstracting service represented by the "Literature List" has been maintained periodically. The London Conference was a variant on the provincial meetings held in previous years, and took place simultaneously with an exhibition illustrative of recent progress in electrodeposition, the first of its kind ever held in this country. Closer co-operation with the American Electroplaters' Society and the American Electrochemical Society has been established.

Hotel Lighting.

The Third E.D.A. Conference of the 1930-31 Session.

THE December Salesmanship Conference of the British Electrical Development Association, which was held at the Royal Society of Arts in London on December 19th, dealt with the "Sales Aspect of Hotel Lighting." Mr. C. H. Cox was in the chair.

Mr. R. C. Hawkins (North-West Area Officer, E.D.A.) read a paper on the subject, remarking that there were some 6,400 hotels in Great Britain. These were generally classed into three groups, *viz.*, the luxury hotel, found principally in London; the large general hotel, which also existed in London, but perhaps to a larger extent in the provinces; and the seaside hotel, which included luxury hotels down to the boarding house. Speaking in quite general terms, he said that there were openings for lighting in respect of the canopies to be found over the fronts of the large hotels, and for floodlighting for the general exteriors of hotels. In the foyer and main hall, architectural and other forms of efficient lighting could play a great part in making guests feel comfortable, and in this connection special reference was made to the foyer of the Strand Palace Hotel, a wonderful example of architectural lighting which used no less than 55 kW in the main hall alone.

After a passing remark as to the advantage of a well-lighted reception room, and also urging serious attention to the lighting of the lounge, coffee room, and other public rooms, Mr. Hawkins spoke emphatically on the inadequate lighting often to be found in so many hotel bedrooms in this country. He said that there should not only be a well-lighted dressing table, but a light over the bed with a switch which could be manipulated from the bed, while lamps in cupboards and wardrobes were often necessary.

Kitchens and corridors were next named as a field for increased business, whilst the subsidiary uses of lighting mentioned included chambermaids' signals instead of bells, indicator signs, to enable visitors to find their way about the hotel, and also special indicator signs in the public rooms to inform any visitor, by displaying the number of his room, that he was wanted. Reference was also made to the lighting of telephone booths, inquiry bureaux, post offices, barbers' shops, &c. Mr. Hawkins said that in very few hotels in this country could one read or write in comfort, shave, or read in bed. The E.L.M.A. was engaged at the present moment in a survey of the existing conditions, and although this was by no means completed, some interesting figures had been made available. So far, only 318 hotels out of the possible 6,400 had been surveyed, and they had been divided into two sections on the basis of the A.A. classification. Thus, 46 of the hotels so far surveyed were of the largest and best appointed type, whilst the remaining 272 were of a rather lower class. Although the figures for the first-named showed a considerable improvement over those in the second section, they related to very much fewer hotels. However, it had been found that fewer than half of the better establishments and only just over a quarter of the others used lighted exterior signs. The figures for interior signs were 46 per cent. and only 1 per cent., respectively. It was found that in 83 per cent. of the hotels in the first section and in only 53 per cent. in the second, was it possible to read comfortably in any chair. In both classes of hotel there was a great variation in intensity in various parts of the room, and floor or table standards, whilst found in about half of the better hotels, were sadly lacking in the remainder. The figures so far available indicated that much the same conditions as these were to be found in the dining rooms, and that many improvements were possible. As regarded bedrooms, only 19 per cent. of the hotels in the first section were equipped with three lighting fittings, whilst in the second type of hotel only 1 per cent. were so fitted. Indeed, two-thirds of the bedrooms in the lower-class hotels of the two classes in question had only one fitting, 28 per cent. of the better hotels and 64 per cent. of the others had no mirror lighting at all, and where this did exist, it was almost, without exception, in the form of a pendant. Although it had been found possible to read comfortably in bed in 83 per cent. of the bedrooms in the better-class hotels, this could only be done in 36 per cent. of the bedrooms in the other hotels. Further, in only one-third of the latter was it possible to switch the light on or off from the bed. In each section, nearly 90 per cent. of the bedrooms were equipped with visible lamps. Therefore, it was quite apparent that very few indeed, if any, of the hotels surveyed really conformed to a standard of lighting which could be accepted as satisfactory.

Discussing the potential market for lighting fittings, wiring, lamps, &c., the speaker pointed out that, according to the A.A. Handbook, which listed only 2,195 hotels, there were 87,251 bedrooms, many of which were equipped with obsolete lamps in clear glass "shades." Taking the total of 6,400 hotels already mentioned, it was emphasised that there were this number of foyers, dining rooms, lounges, &c., the great majority of which were far from adequately equipped. This represented a large load which, it was suggested, would be well worth having, seeing that, on account of the longer hours of use compared with ordinary domestic lighting, the load factor would be vastly improved. Mr. Hawkins expressed the view that there was a very definite and urgent need for a hotel-lighting campaign—a concentrated effort to convince those responsible for the equipment of hotels of the "guest attracting" value of light. Whilst perhaps not quite so spectacular as the campaign just completed, the potential market was just as great, if not greater. It was essential, however, to educate the architect in order that the lighting installation might be planned with the remainder of the building or, where adaptation had to be resorted to, might be carried out with some measure of architectural effect. This applied particularly to ballrooms.

Finally, the author stressed the importance, from the general advertising point of view, of well-lighted hotels, because not only people who stayed in them as residents from time to time, but also those who visited them for the purpose of public dinners, dances, &c., would be so impressed with the convenience of adequate lighting that they would desire to apply similar principles in their own homes.

Discussion.

Lt.-Col. W. A. Vignoles (Director and Secretary, E.D.A.) opened the discussion and agreed that the subject was of sufficient importance to be considered from the point of view of a special campaign. The money value of good lighting should be impressed upon hotel keepers. In America the hotel bedrooms had five or six lighting plugs so that a visitor could have light wherever he desired it. He felt, however, that any lighting campaign of this kind should be linked up with other uses of electricity, such as hot-water supply, radiators in bedrooms, refrigeration, vacuum cleaners, and so on.

Mr. L. L. Robinson (borough electrical engineer, Hackney) said that in his opinion a hotel should be a home from home, and he hoped that all hotels would not be made into "jazz" dance pavilions with excessively brilliant lighting. He advocated moderation in all things in spite of what had been said of the Strand Palace and similar hotels. A most useful thing was a light over the bed, whilst one convenience used very much in Germany was a switch at the bedside which controlled the lock on the door.

Mr. G. S. Francis (E.D.A.) said that in many hotels of quite good class it was still possible to find bedrooms with only one switch, which was by the side of the door, and only a single light, usually very badly placed. He suggested that the lighting in hotels should be of a warmer character instead of brilliant white, as was so often the case. In one hotel in the Midlands there was a radiator in the bedrooms for which 4d. an hour was charged, or 2d. half an hour; but the room in which he stayed was 10 ft. by 12 ft., and had only one 40-watt lamp, whereas two 60-W lamps were necessary for a room of that size.

Mr. W. J. Jones (E.L.M.A.) spoke of the use of light in hotels for decorative purposes, and said that the installation in the main hall of the Strand Palace Hotel, which had been referred to, was purely for decorative purposes. He knew of one hotel in Brussels in which there were ten lighting points in each bedroom and, as in the case of hotels the load factor was 30 or 40 per cent., the supply could be given at advantageous rates. There was also a field for development in lighting the hairdressers' saloons in hotels. Referring to the survey being made by the E.L.M.A., he said that he believed that similar efforts were being made in certain Continental countries along the same lines, and possibly in 12 or 18 months it would be possible to secure a reasonable comparison of the position in this country with that in others.

Mr. Tommins (Manchester) spoke of the favourable load factor of hotel use of electricity in London inasmuch as many hotels were open from early morning until late at night or all day. In other cases, however, the use was not quite the same, and therefore the load factor was poorer, so that the price would be less favourable, and in those cases it was necessary to consider the cost of such installations as had been referred to. A two-part tariff would encourage water heating for storage purposes and other uses and enable the hotel management to obtain night energy at a low figure.

Mr. Summers urged the need for a campaign to encourage "all-electric" hotels rather than to concentrate on lighting alone.

Mr. R. W. Kennedy spoke of experiences in hotels so out-of-date as to have the lighting switches for the bedrooms outside the doors and of the need for educating at least some of the public.

Mr. Hawkins, replying to the discussion, agreed as to the need for a campaign for the general use of electricity in hotels, but said that he had concentrated on lighting in the paper in order to keep the discussion to that one point, and not to complicate the issue.

British Industries Fair.

Exhibitors at Birmingham.

FROM the list of exhibitors at the Birmingham Section of the 1931 Fair we have extracted the names of about 130 companies and firms whose displays will be of an electrical character or will bear some relationship to the electrical industry. These names are given below in alphabetical order; it is not claimed that the list is complete and, if necessary, a supplementary list will be published later:—

Aerograph Co., Ltd.
Allen-Liversidge, Ltd.
Ashdown, H. E. (Birmingham), Ltd.
Avery, W. & T., Ltd.
Babcock & Wilcox, Ltd.
Bakelite, Ltd.
Beeantee Illuminations, Ltd.
Belling & Co.
Berkeley & Young, Ltd.
Berry's Electric (1928), Ltd.
Beuttell, A.W., Ltd.
Birkbys, Ltd.
Birmingham Electric Furnaces, Ltd.
Birmingham Electric Supply Department.
B.K.B. Electric Motors, Ltd.
Blackstone & Co., Ltd.
Bowker, S. O., Ltd.
Braidwood, P. M.
Bray, Geo., & Co., Ltd.
British Dardelet Threadlock, Ltd.
British Electrical Development Association.
British Electric Transformer Co., Ltd.
British Engineering Standards Association.
British Insulated Cables, Ltd.
British Sangamo Co., Ltd.
British Thomson-Houston Co., Ltd.
British Vacuum Cleaner and Engineering Co., Ltd.
Brownie Wireless Co. of Great Britain, Ltd.
Brown, S. G., Ltd.
Bulpitt & Sons, Ltd.
Canning, W., & Co., Ltd.
Carron Company
Cellon, Ltd.
Chesterton, Jones & Co., Ltd.
Chloride Electrical Storage Co., Ltd.
Clear Hooters, Ltd.
Cosway, G. P., Ltd.
Credenda Conduits Co., Ltd.
Crossley Bros., Ltd.
Davey, Paxman & Co., Ltd.
Davidson & Co., Ltd.
Davis & Timmins, Ltd.
De la Rue, Thos., & Co., Ltd.
Dermatine Co., Ltd.
Donovan & Co.
Earle, Bourne & Co., Ltd.
Ebonestos Insulators, Ltd.
Edison Accumulators, Ltd.
Electrical Power Engineers' Association.
Elliott, E.
Ellison, George, Ltd.
Ellison Insulations, Ltd.
Ellmar Mouldings Co.
Evered & Co., Ltd.
Falkirk Iron Co., Ltd.
Ferguson, Pailin, Ltd.
Fielding & Platt, Ltd.
Foster Instrument Co.
General Electric Co., Ltd.
Gent & Co., Ltd.
Gilman, F. (B.S.T.), Ltd.
Gledhill, G. H., & Sons, Ltd.
Gramo-Radio, Ltd.
Guest, Keen & Nettlefolds, Ltd.
Harper, John, & Co., Ltd.
Hawkes, O. C., Ltd.
Heatly-Gresham Engineering Co., Ltd.
Herbert, Alfred, & Co., Ltd.
Hick, Hargreaves & Co., Ltd.
Holden & Hunt.
Hollings & Guest, Ltd.
Holmes, J. H., & Co., Ltd.
Hoover, Ltd.
Horstmann Gear Co., Ltd.
Hotpoint Electric Appliance Co., Ltd.
Imperial & International Communications, Ltd.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
Jackson Electric Stove Co., Ltd.
Johnson, Rd., & Nephew, Ltd.
Le Carbone, Ltd.
Lighting Trades, Ltd.
Lister, R. A., & Co., Ltd.
Lundberg, A. P., & Sons, Ltd.
Maestrophone Radio Gramophone & Wireless Co.
Marshall, Sons & Co., Ltd.
McGeoch, W., & Co., Ltd.
Micanite & Insulators Co., Ltd.
Midland Fan Co., Ltd.
Morgan Crucible Co., Ltd.
Moulded Products, Ltd.
Murex Welding Processes, Ltd.
National Accumulator Co., Ltd.
National Gas Engine Co., Ltd.
National Time Recorder Co., Ltd.
Newalls Insulation Co., Ltd.
Oldham & Son, Ltd.
Parsons, C. H., Ltd.
Peters, G. D., & Co., Ltd.
Petters, Ltd.
Pneulec, Ltd.
Rainsford & Lynes, Ltd.
Rawlplug, Ltd.
Ray Engineering Co.
Record Electrical Co., Ltd.
Revo Electric Co., Ltd.
Reyrolle, A., & Co., Ltd.
Rowlands Electrical Accessories, Ltd.
Ruston & Hornsby, Ltd.
S. & W. (Lighting), Ltd.
Scott, Hugh J., & Co. (Belfast), Ltd.
Shropshire, &c., Power Co.
Sigma Instrument Co.
Steam Gauge Manufacturing Co., Ltd.
Sturge & Baker, Ltd.
Sturtevant Engineering Co., Ltd.
Tangyes, Ltd.
Taylor & Challen, Ltd.
Telegraph Construction and Maintenance Co., Ltd.
Thermo Path Co., Ltd.
Thomas, Bertram.
Thompson, J. (Wolverhampton), Ltd.
Tucker, J. H., & Co., Ltd.
Turners Asbestos Cement, Ltd.
Vac-Tric, Ltd.
Vivian, H. H., & Co., Ltd.
Wardle Engineering Co., Ltd.
Watford Electric & Manufacturing Co., Ltd.
Young, Osmond & Young, Ltd.

Illumination of Offices.

The importance of providing sufficiently intense light to prevent eye fatigue and avert consequent nervous exhaustion.

(*Extracts from papers read before the* OFFICE MACHINERY USERS' ASSOCIATION *and the* ILLUMINATING ENGINEERING SOCIETY, *London.*)

A REPRESENTATIVE gathering of members of the Office Machinery Users' Association, arranged in connection with the London School of Economics and Political Science, met recently at the Lighting Service Bureau in London to hear Mr. W. J. Jones, M.Sc. (manager of the Bureau), lecture on "The Illumination of Offices." The chair was occupied by Mr. R. Borlase Matthews.

Lighting Bureau Lecture.

The lecturer emphasised the important part played by lighting in modern commerce, and asked what the nature of lighting in the daytime was? It had been said that it was the best form of lighting, but the lecturer would only agree to a qualified acceptance of that view. It would be observed that in the lighting of a modern office there was great intensity of light near the windows, and but little light on the far side of the room; artificial light was, therefore, called in to supplement daylight.

Things to avoid in the office were eyestrain and eye-fatigue. The eye did not function properly under degrees of illumination that varied from 2,000 deg. down to two or three degrees. In the ordinary light of an office the eye functioned with only 25 per cent. of its normal efficiency, and under poor intensity of light the eye positively suffered. One of the most important needs in the realm of research was for full information which would enable one to specify the quality of light to be employed.

The efficient use of artificial light in offices was linked with cost. Few people realised what daylight actually cost. Buildings were now so designed as to admit as much daylight into them as possible, which meant many, or large, windows; they must be cleaned and, furthermore, a large window space meant leakage of heat. In large buildings it was often necessary to introduce light wells, which involved a reduction of floor area and the utilisation of space that could well be employed otherwise more economically. All that meant expenditure.

What should be the nature of the light to be provided in the office? That was a most important question; the first thing to remember was that the modern lamp gave more light, and the first suggestion he would make was to get rid of all clear lamps, and use only "Pearl" or opal lamps. Good illumination was that which was just where it was wanted—on the ledger, desk, calculating machine, or typewriter. It was high time that legislation was introduced to forbid all lighting in offices which produced eyestrain, or any form of myopic distress. A measure was, he believed, before Parliament dealing with this subject, but it did not go far enough, and was content with such a loose expression as "the lighting should be adequate." Some more positive terminology was necessary if the condition of the employé was to be considered in terms of health, efficiency, and production.

In all offices the intensity should be sufficient to avoid all discomfort. The primary condition was the absence of eye-fatigue and the nervous exhaustion arising from it. Office lighting should not be less than 6 or 7 foot-candles, and it was most interesting to note that the cost of eight foot-candles was only ½d. per hour per individual. As to the future of lighting, the gradual elimination of point lighting was probably in favour of large sources.

The lecture was replete with lantern slides and demonstrations, and at its close a number of pertinent questions were put to the lecturer on shadows, energy consumption, colour absorption, &c.

Illuminating Society Paper.

The lighting of offices and public buildings is the title of Mr. J. A. Macintyre's recent Illuminating Engineering Society paper, in which he maintains that architects either do not give the consideration to natural lighting which is essential to good design, or deliberately sacrifice utility in planning to facilitate the creation of pleasing elevations. In fact, the architect who makes fenestration the main factor of his design in a competition for such a building will have little chance of success, and illuminating engineers must recognise this fact before effective assistance can be given on daylight problems, as liberal compromise is likely to be necessary in all cases. On the one hand, the education of an architect does not generally include any intensive study of illumination; on the other hand, very few illuminating engineers know much about architecture, and many of them are so engrossed in the design of artificial lighting units and systems that they lose sight of the daylight problem, and probably could not consider it a retrograde step if architects decided that the whole of a site should be built over, when land values are high, so that in the majority of the rooms artificial light only would be available.

Daylight will be adequate for ordinary clerical work at positions where the daylight factor is not less than 0.2 per cent.; that is to say, except in very dull weather, artificial light will not have to be resorted to in such positions. It is clear, therefore, that the amount of light falling on a site on an average day is more than ten times that required to illuminate every floor of a skyscraper, if it could be distributed effectively. The intensity of artificial light on most pictures in art galleries need not be more than four foot-candles, and many light water colours show up quite well with two foot-candles. There is a tendency to advocate higher intensities; while they might be required for intensive examination of detail, four foot-candles is quite enough to enable one to realise the merits and appreciate the beauties of the artist's work. The danger of exposing valuable pictures to high light intensities is obvious.

For the artificial lighting of offices where special efforts are not required for advertising purposes, nor special fittings to supplement the decorations of the rooms, satisfactory results are easiest to attain when a combination of general and individual lighting is installed. The intensity recommended for ordinary clerical work is an average of three foot-candles at mid-period of decoration and lamp life, with a minimum average of 2.5 foot-candles, and at no point on the working plane should the minimum be less than two foot-candles. There is no evidence either from the point of view of health or output that appears to justify higher figures than these. Preference for artificial daylight in public offices generally is definite only where there is mixing of natural and artificial light. It is only under such conditions, therefore, or where colour contrasts are important, that the use of the less efficient artificial daylight units would appear to be justified. Medical evidence is not definite on the comparison of the systems up to the present.

Self-contained Generating Plant.

Notes on Recent Installations in India and China.

THE accompanying illustrations depict recent installations in India and China of the self-contained turbo-alternator sets which were first developed about two years ago by the Metropolitan-Vickers Electrical Co., Ltd.

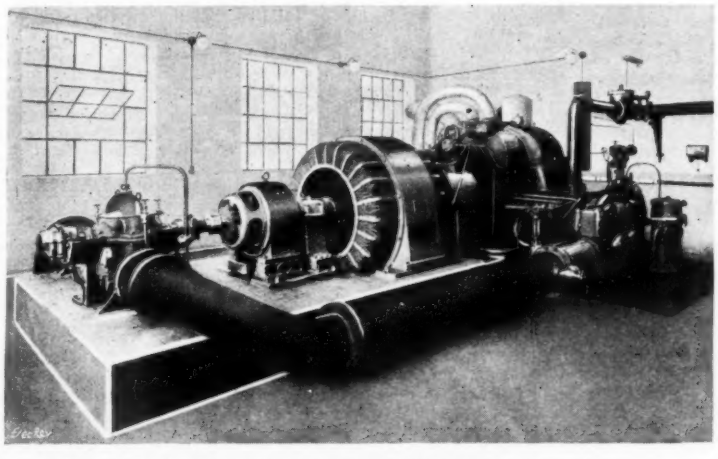


Fig. 1.—The Hua Feng Cotton Mill Turbo-alternator.

Fig. 2 shows three sets recently completed in the new Irwin power station of the Gwalior State Public Works Department, at Moti Jhil, near Gwalior. This power station, named after the present Viceroy, who laid the foundation stone last year, is part of an interesting scheme originated by the late Maharajah Scindia of Gwalior to provide a modern water supply for his capital city of Lashkar and the adjoining old capital of Gwalior. The scheme, continued by the Council of Regency and finally sanctioned in 1926, includes the provision of a filter plant, a pumping station and a reservoir for supplying water at a maximum rate of 4¼ million gallons per day, based on an allowance of 30 gallons per head per day for a population of 150,000.

The Metropolitan-Vickers Company acted as the main contractor for the erection and equipment of the new station, and also for the equipment of the pumping station, which is housed in the power-station building. The steam-raising equipment, supplied by Messrs. Babcock & Wilcox, Ltd., includes three water-tube boilers with integral superheaters, mechanical chain-grate stokers, and a fuel economiser. The generating plant consists of one 1,000-kW and two 500-kW turbo-alternator sets of the self-contained type, in which the condenser is built integral with the turbine and all the auxiliaries are directly driven from the set itself, thus requiring no separate control or external power supply. No condenser basement is required, and there is only a low concrete plinth for the foundations. The turbines are supplied with steam at 200 lb. per sq. in. and 200 deg. F. superheat, and operate at 5,000 r.p.m., each driving its alternator through a double helical single-reduction gear of 5 to 1 ratio. Electricity is generated at 3,500 volts, 3-phase, 50-periods, and a transmission line at this voltage connects with the old oil-engine station, which is now used as a transforming and distributing centre.

Fig. 1 shows a similar set of 1,250 kW in the Hua Feng Cotton Mill of the Japan-China Spinning and Weaving Co., at Woosung. This installation replaces two old 400-kW turbo-alternator sets, and is part of a complete re-equipment of the power plant, new boilers having been installed at the same time. The new set is mounted at the floor level of the old condenser basement, and the concrete plinth is faced with tiles, giving a particularly neat finish to the compact arrangement. The turbine is designed for operation at 5,000 r.p.m. with steam at 300 lb. per sq. in. and 680 deg. F. The generator, 600 V, 3-phase, 60 cycles, 1,200 r.p.m., is gear driven. The equipment includes an automatic voltage regulator mounted on the generator control panel. The installation was completed and put into commission in February, 1930, and a report recently received by the makers from Mr. F. Ohnishi, engineer-in-chief to the Japan-China Spinning and Weaving Company, states that the set has given complete satisfaction in continuous operation since its installation, no trouble having been experienced with any part of the equipment, and the guarantees with regard to steam consumption having been satisfactorily met.

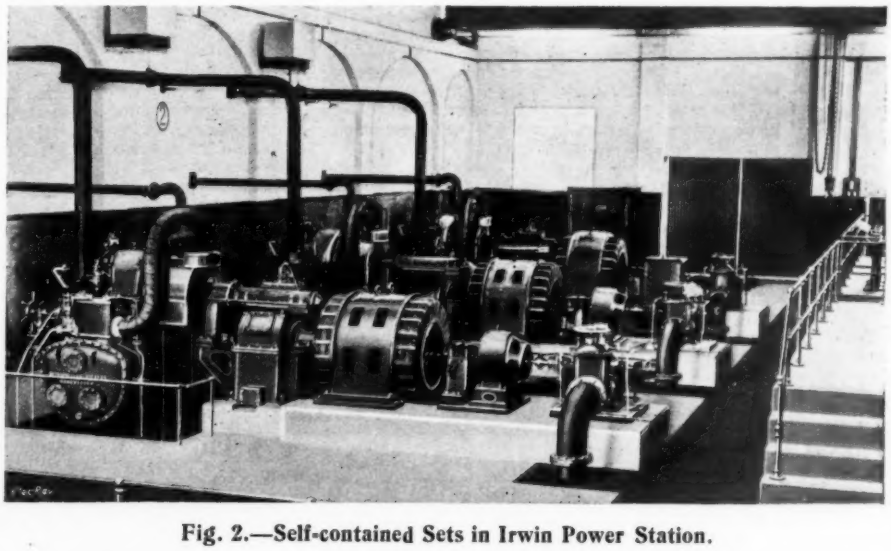


Fig. 2.—Self-contained Sets in Irwin Power Station.

The Fulham Inquiry.

A report of the inquiry by the Electricity Commissioners into the application by the Fulham Borough Council for permission to extend its generating station.

(*Concluded from page* 1113.)

On Wednesday, December 17th, **Mr. J. H. Rider** continued his evidence, and explained in detail the operation of the "Modave" sulphur-removing apparatus. The makers claimed that it would remove 70 per cent. of the oxides and sulphur in the flue gases if six units were used, but he believed that by increasing the number of units it would be possible to remove practically the whole of the sulphur. The only difference between the Modave apparatus and that being experimented with at Battersea was that in the former the gases, by being sent through the tubes in the manner they were, were put into a turbulent condition, whereas at Battersea there were no tubes, water sprays filling the whole space. If the spray method were shown to be more efficacious it would be a simple matter to put it in without altering the design of the flues. Five groups of tubes made up one unit of the Modave apparatus, and it was proposed to fit four to each boiler. The water supply for the gas washers would probably use 5 per cent. of the condensing water and would be taken from the circulating-water outlet. The subsequent treatment of this water, before it was returned to the river, might involve settling tanks and perhaps towers, and these had been taken into consideration in his estimates.

Boilers and Load Factor.

Passing to the figures of capital expenditure, Mr. Rider said the cost of the first stage (£2,790,935) would be £21,143 per kW installed, whilst the total capital expenditure on the completed station (£5,530,050) would be £17.39 per kW installed; these were high figures if taken on the usual basis of computing the cost of power stations in the past, but in the present case—and this would apply to all similar stations in future—the Central Board had given instructions for the provision of boiler plant sufficient for the whole of the installed plant, which was not the practice previously, plus an amount of boiler plant necessary to allow for periodical overhauling, cleaning, &c. These extra boilers increased the cost of the plant and buildings; there was also the cost of the sulphur-eliminating plant, and the cost of the higher chimneys necessary to carry the gases away. These items alone accounted for £500,000 of the capital expenditure, and land was also very expensive. The cost per kW on the usual basis for smaller stations would have been £15.24 and £13.959, respectively, for the two stages.

Generating Costs.

Mr. Rider said that the cost of coal with a calorific value of 10,600 B.th.u. per lb. had been taken at 16s. per ton at the wharf. The kWh generated at the first stage would be 543,645,600 (522,315,000 delivered to feeders). The thermal efficiency of the station was estimated at 25 per cent., and the load factor at 50 per cent., with a cost per kWh generated in the first section of 0.2551d. (0.2658d. sent out). When the station was fully completed for a maximum load of 310,300 kW (298,100 kW sent out) the cost per kWh generated would be 0.2333d. (0.2428d. sent out).

He pointed out that in his report to the L.C.C. in 1921 he recommended a new up-river station in order to avoid the high cost of transmission from a station below the bridges. In October, 1926, he made a report to the London and Home Counties J.E.A. in which attention was drawn to striking developments in the western and north-western areas which markedly changed the position since his 1921 report, and still more so since the report of Messrs. Merz & McLellan in 1914. As a result of his 1926 report, the London and Home Counties J.E.A. promoted the Bill for the Chiswick station which was passed by both Houses of Parliament, subject to the proviso that the station was not to be built unless it was made a capital station by the Central Board. The Board, however, decided in favour of Fulham, and subject to effective steps to prevent nuisance, this scheme was the most suitable one.

Sir Frank Baines, F.R.I.B.A. (formerly director of works, H.M. Office of Works and Public Buildings), called on behalf of the L.C.C., said that he had estimated that over a period of years it would require £1,000,000 to put the Houses of Parliament in a suitable state of repair, following damage due to atmospheric pollution. The chief cause of the impurity was sulphur, which directly attacked the calcium-carbonate in lime stone and also the agglutinant in sandstone. He had formed the opinion that a great deal of the damage done to the Houses of Parliament was due to Lots Road power station. Modern methods of completely burning coal in large power stations resulted in a larger proportion of the sulphur in the coal being extracted and sent up the chimney, and the area affected might be up to 40 miles from the power station.

Sulphur Elimination.

Mr. J. H. Rider then resumed his evidence, and said he had seen tests of the Modave apparatus at Billingham in February, 1930, when it was dealing satisfactorily with the extraction of dust primarily and also sulphur incidentally, but he had seen no tests yet of the apparatus used solely for the extraction of sulphur. The Fulham apparatus was put into operation for the first time a week or ten days ago. He believed that at least 90 or 95 per cent. of the sulphur could be extracted. It would be possible, with 1 per cent. of sulphur in the coal, to emit one or two tons of sulphur into the air per day from a station like Fulham, and, even assuming nothing better could be done, it was a vast improvement over the position hitherto, because, instead of one or two tons, from 18 to 20 tons of sulphur would have been put into the atmosphere for the same quantity of coal burned. He thought the policy of the L.C.C. should be to stop the existing power stations in London from sending all their sulphur into the air, rather than try to prevent the erection of a station which would not, in his opinion, emit any sulphur worth speaking about.

The makers of the Modave apparatus had guaranteed that if it did not extract dust and sulphur to a degree which would satisfy the Fulham Borough Council, the plant would be taken back without payment of the contract price of £3,700.

Mr. Rider continued his evidence on Thursday. He said that the figure of £198,000 given by Mr. Hobson on Tuesday, as representing the increased working expenditure in 1940-41 if the station were erected at Erith instead of at Fulham, was arrived at after taking site values into consideration.

With regard to the smoke problem, it was stated that 19 million tons of coal were used annually in the Metropolitan Police area, which extended roughly 15 miles around Charing Cross. The three-quarters of a million tons per annum burned at the Fulham station would not be a direct addition to the existing consumption of coal in London, but would be in substitution for a greater amount; further, it would be burned more efficiently at the Fulham station than in ordinary grates or factories, or in less efficient generating stations. Washed coal had been used in generating stations for years, but at Fulham they proposed to use "clean" coal, *i.e.*, coal which had been further treated in order to remove non-combustibles, and sulphur, as far as possible.

Dr. Florence Barrie Lambert, C.B.E. (chairman of the Central Public Health Committee of the L.C.C.), recalled that in 1927 the Council had entered objections with regard to the London Power Co.'s station at Battersea, because of the danger apprehended from smoke and grit, but withdrew its opposition in view of the guarantees secured from the London Power Co., embodied in an agreement. At that time, however, there was not a full appreciation of the facts in regard to sulphur fumes, and in 1929, after experience in connection with a station at Manchester, the Council had considered that an entirely new position had arisen. The Council had heard of the Modave method for dealing with sulphur for the first time at this inquiry, and had no reports on the results obtained.

The Chemical Problem.

Dr. R. Lessing (consulting chemist to the Fulham Borough Council and a founder member of the Committee for the Investigation of Atmospheric Pollution) said that there was no difficulty whatever in dealing with dust, grit, or ash. These were arrested mechanically by cyclonic dust extractors, which removed 90 per cent., the remaining 10 per cent. being removed by the washing process. For the elimination of oxide of sulphur, a process was to be used involving the washing of the gases with water to which neutralising agents, such as chalk or lime would be added, if necessary. It had been used for the absorption of sulphur dioxide, and also in gasworks for the absorption or extraction of ammonia gas on a large scale. The sulphur content of commercial coals ranged from ¾ to 3, and sometimes even to 4 per cent., the bulk of it being in the form of iron pyrites, though a portion was present as organic sulphur. As a result of combustion, it was produced

as sulphur-dioxide, and, when the flue gases were brought into intimate contact with water, the sulphur-dioxide was preferentially absorbed by the water from the mixture of gases. From the chemical point of view, there was no difficulty whatever in extracting practically all the sulphur-dioxide from the gases. Tests on the Fulham plant had resulted in 100 per cent. efficiency in sulphur removal in two cases. An agreement had been reached with the Port of London Authority as to the effluent to be discharged, and the tests indicated that they could meet the conditions imposed.

Discussing the general question of the pollution of the atmosphere of London, he said it had been stated that the ratio of domestic to industrial smoke pollution was 2½ : 1, but he considered that that estimate favoured the domestic source. The complete elimination from the atmosphere of sulphur due to combustion—if that should be desirable—was impossible so long as there were hundreds of thousands of individual fires to which the same treatment could not be applied as was possible in the case of a concentrated unit.

It was suggested that very fine particles of dust which were not arrested mechanically would tend to offer further obstruction to the rays of the sun, but Dr. Lessing replied that these particles were of the type which reflected light. With regard to carbon-dioxide, which represented some 10 per cent. of the chimney gases, Dr. Lessing expressed the view that the effect of the gases would be to pierce the fog in such a district as Fulham, because the gases were emitted at a higher temperature than the temperature of the air.

Load Development at Fulham.

Mr. A. J. Fuller (borough and consulting electrical engineer at Fulham and president of the I.M.E.A.) spoke of the development of the undertaking at Fulham and the effect of price reductions on the domestic demand. Between the period 1920-21 and 1929-30 the total increase in electricity sold was 150 per cent., from 8.67 million to 21.239 million kWh. The lighting charge had decreased from 7d. in 1920-21 to 3½d. in 1929-30, and the power charge from 1½d. to ¾d. per kWh. The effect of keeping the charges to the lowest possible figure was that the number of consumers had increased from 7,245 to 16,175 in 1929-30, and the consumption was now 140 kWh per head of population per annum. An all-in tariff was instituted in 1928, and in the two years since then 3,500 different pieces of domestic apparatus had been installed by the Borough Council in consumers' premises, quite apart from the many pieces installed by consumers themselves of which the Council had no record. This development had not taken place in the better-class properties only, because of the 444 electric cookers on hire, 232 were in houses having a rateable value of less than £22 per annum. The Council could not keep pace with the demand for domestic electrical apparatus at the present time.* He added that if 95 per cent. of the sulphur in the large quantity of coal to be burned at the new Fulham station was extracted, the quantity emitted would not be more than that from the existing Fulham station (the chimney of which was only 75 ft. high), concerning which no complaint had been made.

Reasons for Opposition.

Mr. Singleton, K.C., for the L.C.C., said the whole object of the Westminster City Council and the Kensington and Chelsea Councils was to prevent the pollution of the atmosphere of London. It was only during the last two years, since the Manchester case, that the significance of the problem had been appreciated. The L.C.C. regarded the Grove Road sulphur-extraction tests as satisfactory so far as they had gone, but it was asked that such tests should be carried out over a long period before further power stations were sanctioned for London. The figures given to the Commissioners with regard to the Modave apparatus related only to a few weeks' testing.

In conclusion, Mr. Singleton emphasised the point that the L.C.C. did not wish to stand in the way of development, but urged that, if the Commissioners did sanction the proposal, stringent conditions should be imposed on the promoters to prevent atmospheric pollution. He expressed the hope that the decision of the Commissioners would be delayed to enable further tests to be carried out.

Dr. J. S. Owens (Superintendent of Observations on Atmospheric Pollution, Department of Scientific and Industrial Research) said that if the flue gases were about the same temperature as the surrounding air, they would tend to fall. In order that they should rise, there should be a difference of at least 48 deg. between the temperatures of the flue gases and the surrounding air. That, however, was the minimum, and he, personally, believed there would be a grave danger to public health under certain conditions, such as still air, to people in the neighbourhood immediately surrounding the power station.

Dr. J. S. Haldane gave evidence on the causation of fog, and said that, from the public health point of view, gases emitted from such power stations as that proposed at Fulham should not exceed .01 or .02 grain per cubic foot of gas. He would recommend the L.C.C. to accept the latter figure.

At the opening of the concluding day, Saturday, December 20th, **Mr. Trevor Watson,** K.C., handed in a statement containing conditions which the L.C.C. suggested should be imposed if the Commissioners decided to consent to the construction of the Fulham power station. These conditions may be summarised as follows:—

(A) Sulphur content of the effluent gases not to be more than .02 grain per cu. ft. expressed as sulphur.

(B) No visibly dark or opaque smoke to be emitted; the emission, to a certain extent, of condensed steam in cold weather to be tolerated.

(C) No grit or other particles to be emitted to cause a nuisance.

(D) Chimneys to be not less than 300 ft. high; arrangements to be adopted for warming the gases before discharge.

(E) In respect of water discharges into the River Thames, an undertaking and powers to be given to the London County Council in the same terms as those given to the Port of London Authority.

(F) Periodic analyses of the effluent gases and discharged water to be made by the chemists of the undertakers, and an opportunity to be afforded to the appropriate officers of the London County Council to inspect during tests and verify results, and to make such other tests as they may deem necessary.

(G) Any improved plant or devices hereafter discovered to be introduced into the Fulham power station if required by the Electricity Commissioners.

Mr. J. A. Robertson (consulting engineer, formerly chief electrical engineer at Salford) expressed himself in favour of large power stations being erected outside the areas of supply, and instanced the Hams Hall power station of the Birmingham Corporation, the Portishead station of the Bristol Corporation, and the Kearsley station of the Lancashire Electric Power Co. He regarded the experiments at Grove Road as very promising indeed, but the plant was somewhat costly and elaborate, and he would like to see experiments on a larger scale before installing a plant of that kind for regular working.

Mr. Robertson expressed the view that the area of the Fulham site was not sufficient for a base-load station of 300,000 kW, and that there was insufficient coal storage, which should be for a minimum of five or six weeks. Moreover, there was no railway communication to the Fulham site.

With regard to noise from transformers, he mentioned the case of three 10,000-kVA transformers at Blackpool in connection with the bulk supply from Preston, where there had been complaints of noise and the threat of legal proceedings. The makers said that it was impossible to design them in such a way as to avoid the humming complained of. He suggested it would be unwise to erect a big power station in the centre of London until further experiments in the elimination of sulphur fumes had been carried out. Perhaps the solution was nearer than many engineers might think, and it seemed to him that a combination of electrical undertakings should carry out experiments on a larger scale than had hitherto been done (*e.g.*, on a 50,000-kW plant), because the risk of legal action involving the shutting down of such a large power station as Fulham was too great in the present position of the experiments.

Mr. Tyldesley Jones, K.C., addressing the Commissioners on behalf of the promoters and bringing the inquiry to an end, said the Central Electricity Board had no interest in the matter except to secure the best site in the interests of cheap electrical generation. Wherever the station was put, it must be carried on without creating a nuisance, and in the absence of a solution of the sulphur-emission problem, the danger to health and buildings would continue even with stations below the bridges, because experience had shown that the area of damage extends over a greater distance than many people imagined. At the same time, he claimed that the experiments at Grove Road by Dr. S. L. Pearce and the London Electric Power Co. had indicated that suphur could be substantially removed, because, so far as these experiments had gone, it had been shown that the apparatus extracted all but 0.009 grain per cu. ft. of gas. It was because the Government Committee expressed the view that the Grove Road method could be improved in certain directions, particularly in regard to cost, that the engineers advising the Fulham Council had taken up the Modave process. He invited the Commissioners to ask the Government chemist to lay down the details of tests upon the Fulham plant and themselves to supervise these experiments. If the Modave process could not be made to work within the limits set by Dr. Haldane, then it should be scrapped and the Grove Road system adopted. On that basis the Fulham power station could safely be sanctioned by the Commissioners. It was not a difficult detail in design to ensure that the gases should be sufficiently hot on emission to go upwards. In conclusion, he dealt with the general advantages from the smoke abatement point of view, and claimed that one central power station, efficiently designed and managed, must create less pollution of the atmosphere than would the larger amount of coal which would have to be burned in houses and factories if cheap electricity were not available.

The Commissioners will give their decision in due course.

* For further accounts of load developments at Fulham, see ELECTRICAL REVIEW of September 27th, 1929, and November 28th, 1930.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

An Overhead-line Pull-down Switch-fuse.

In order to meet the demand for economical, reliable, and easily-operated protective gear for controlling transformer stations in rural areas ELECTRIC CONTROL, LTD., Brighton, have developed the "Empire" pull-down, triple-pole switch-fuse, 200 A, 11,000 V, of which the fuse-mount can be lowered to a convenient level from the ground for the replacement of blown fuses. In designing the switch due consideration has been given to the problem of bird interference, the construction being such as to discourage birds from alighting near the live parts. The switch is easily erected and lined up on existing structures, and is suitable for single, A, or H poles. The fixed insulators are stressed in compression, and the moving insulators are made of "Steatite" porcelain and assembled in a moving system with suitable stops for preventing undue bending stresses. A rugged wooden clamp is employed between the phases to couple the moving insulators. At the ends of each moving insulator, heavy-section brass combined contacts and fuse-carriers are cemented on under the "Empire" steam-set process. The fixed-contact jaws are of hard-drawn, high-conductivity copper, and are fitted with arcing horns. Precautions are taken to ensure that the fuses cannot fall out of the clips when opening a short-circuit. The moving portion of the switch is mounted on a tubular steel frame hinged on a bracket attached to the pole or structure, the position of the hinge being so disposed that when the switch is pulled down the fuses are at a convenient height from the ground, fig. 1, allowing easy replacement. The lower end of the operating rod is fitted with a forked lever which can be padlocked in position when the switch is closed, so as to prevent unauthorised operation. To relieve the operator from supporting the weight of the moving portion when operating the switch, springs are provided which function as counterweights, thereby reducing to the minimum the effort required to operate the switch. All current-carrying parts and springs are cadmium plated, and all the steelwork is hot galvanised. "Empire" carbon tetrachloride fuses are used, which have a high rupturing capacity, and are rapid in action, thereby causing the minimum disturbance to the system. An important feature of the fuse is the fact that a blown unit can be easily detected from the ground in daylight, thus assisting the engineer to locate a fault rapidly.

Fig. 1.—"Empire" Switch-fuse; "Open."

Automatic Adjustment for Steel-mill Rolls.

In rolling steel through a mill the ingots naturally become smaller at each passage through the rolls and, consequently, the rolls must be brought closer together. It is common practice for an operator to make the adjustments manually after each passage of the ingots through the rolls, but with automatic screw-down controls which are being installed in a steel mill in Chicago the predetermined amount of "screw-down" is arranged for by plugging in leads at certain points, and, when the mill is in operation, this "screw-down" is provided automatically at the correct intervals. In this way one man alone can operate the entire mill, and when the work is ready to begin he simply operates a master switch which starts the screws turning for proper adjustment for the first pass. Sights indicate when everything is ready. After the beam of iron or steel has passed through the mill the operator moves the master switch to the second position, and so on. By throwing the switch to the "off" position the operator may resort to manual control at any time. The accompanying illustration, fig. 2, is one of the new automatic screw-down controls on test in the manufacturer's shops, showing the 230 contacts through which the operation is controlled. As the screw-holder (shown in a vertical position) is rotated, its sliding contact meets the spirally-mounted contacts on the stationary "Micarta" panel, energising the circuits that provide the correct spacing between the rolls of the mill. The automatic screw-down is an example of eliminating the uncertain human element from industry, and it may be an indication that the operation of steel mills entirely automatically is a future possibility.

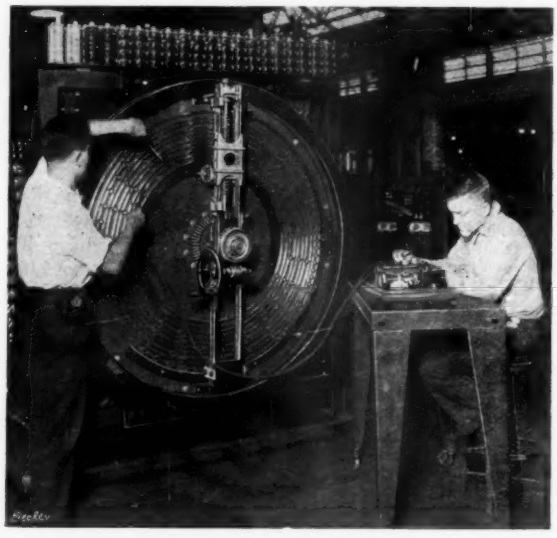


Fig. 2.—"Screw-down" Controller for Steel-mill Rolls.

A New Ship-wiring Cable.

In "Ship Wiring," a recent publication of British Insulated Cables, Ltd., Prescot, Lancashire, is described new "H.R." cable which has been produced by the company to withstand the exacting conditions of vibration, &c., demanded by modern ship design. The leading feature of this cable is the replacement of the lead sheathing by a sheathing of special flexible waterproof material which is highly resistant to vibration, abrasion, and mechanical damage. This material is also practically inert to the action of hot engine oil and sea water, and has proved its suitability for ambient temperatures up to 150 deg. F. Over this sheathing are applied a tape, braid, and special paint, in order to protect the sheathing from mechanical damage. The dielectric is homogeneous, and consists of a high-grade vulcanised rubber specially designed for high ambient temperatures. The layer of pure rubber usually applied next to the conductors is omitted, on account of its being unsuitable for conditions where high temperatures have

to be contended with. In the case of single cables the conductors are insulated with this vulcanised rubber, which is sheathed by the special flexible material, followed by tape, braid and paint. For multicore cables it is considered necessary to eliminate the jute wormings between the cores. The cores, insulated with vulcanised rubber and taped distinctively, are laid up with a soft rubber centre where necessary, and then wormed and sheathed with the special material and protected with tape, braid, and paint. The new cable has successfully withstood severe tests over a considerable period at the National Physical Laboratory.

It is interesting to note that on the White Star liner *Britannic* 100 miles of "B.I. H.R." cable is installed.

Standardisation Specifications.

Publications of the British Engineering Standards Association.

The following notes relate to some of the B.E.S.A. specifications issued during the past few weeks.

Insulating Varnish.

B.S.S. No. 119-1930 deals with Clear Baking Oil Insulating Varnish suitable for the general dipping or impregnation of coils used for motors, generators, transformers, and the like. The specification lays down limiting values for drying time, electric strength, resistance to moisture, ageing, and acidity or alkalinity, and recommendations are made with regard to volatile matter, specific gravity and viscosity. Tests to ensure compliance with the provisions of the Specification are detailed in appendices, and optional tests for effect of oil and for flash point are also included.

Telegraph and Telephone Terms.

Specification No. 204-1930 is a revision of the 1924 edition of the B.S. list of Terms and Definitions Used in Connection with Telegraphs and Telephones. In the new edition a number of new terms have been added in order to cover recent developments, particularly as regards automatic telephony; at the same time a number of terms not now in general use have been deleted. A new section has been included, dealing with trunking terms, and a sub-section on transmission has been added to Section 93, Circuits. The additions and deletions have involved the renumbering of the terms throughout, but otherwise the arrangement of the revised specification is on the same lines as that of the 1924 edition.

Overhead-line Insulators.

An important revision of the British Standard Specification for Porcelain Insulators is No. 137-1930. The 1922 edition was limited in scope to insulators suitable for use on lines of pressures up to 150 kV, whereas the new specification is applicable for pressures up to 350 kV. The most important feature of the new specification, apart from its extended scope, is the table of test-voltages, which differs in several respects from the table in the old specification. The insulators are identified by arbitrary "rating numbers," for each of which a series of tests has been laid down. The table does not attempt to establish a rigid relationship between the test-voltage and the working voltage, since in practice this relationship is a variable factor, largely influenced by climatic conditions. In a separate table, however, a recommendation is given regarding the circuit voltages for which the lower-voltage sizes of insulators are suitable, since experience has shown that for these particular sizes the insulators may normally be satisfactorily assigned to certain definite circuit voltages. For all the higher pressures there is no definite instruction with regard to the relation between the size of insulator and the circuit voltage, but a formula, agreed upon by the International Electrotechnical Commission, has been given as an indication of the maximum circuit voltage to be associated under any conditions with a particular size of insulator. A further feature of the specification is that the order of the tests has been arranged in such a way that each test may have a material bearing upon the behaviour of an insulator in subsequent tests. Interesting additions are an appendix on impulse-voltage tests and an appendix on the co-relation of electric strengths of insulators on the line and on apparatus connected thereto.

Tungsten-filament Lamps.

The 1930 revised edition of the British Standard Lamp Specification No. 161 again marks a very considerable advance over the edition it supersedes (that of December, 1928). The rapid improvement in manufacture in the last two years enables the specification to provide that lamps shall give a better light output without reduction in the minimum average life (1,000 hours). Gasfilled lamps up to and including the 100-watt size are now standard only with internally-frosted bulbs, the light absorption being so small that the figures for the light output remain the same whether the bulbs are internally frosted or clear. It is hoped that the standardisation of the inside-frosted lamp will minimise the use of clear-bulb lamps in positions where the glare of the naked filament is harmful. Manufacturing tolerances on individual lamps are reduced, so materially helping the illuminating engineer to design more accurately lighting installations. Permissible variations in efficiency are also substantially reduced. The schedules have been simplified and improved, and the normal lighting lamps, whether vacuum or gasfilled, appear in one schedule. The ratings below 40 watts have been rearranged so as to provide a more logical sequence, 15 and 25 watts taking the place of 10-, 20- and 30-watt lamps. In addition the specification provides that the maintenance of light throughout life shall be better than formerly. The conditions of testing have been simplified, and the minimum number of lamps for life test to assess the value of a batch of lamps has been reduced, as the greater uniformity in manufacture makes this possible. The improvement of 'bus lighting equipment has necessitated the revision of the schedules for 'bus lamps, which are now universally rated at 12 V instead of the old 14 V. The British Standard Lamp Specification is in almost universal use in Great Britain, and it is interesting to note that it is adopted as standard in many countries outside England.

Copies of the above Specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d. each post free.

The Lighting of Mines.

An outline of proposals circulated to the coal-mining industry by H.M. Mines Department with a view to securing an improved standard of illumination generally by means of both safety lamps and general lighting.

THE Secretary of State for Mines announces that he has been carefully considering the subject of artificial lighting in and about mines. The outstanding importance of better lighting below-ground in the prevention and cure of miners' nystagmus and in the prevention of accidents, and of lighting generally as a factor in efficient and economical working, has been increasingly recognised during recent years. The restrictions imposed by underground conditions generally, and more particularly by the risk of explosion, are formidable, but substantial improvement has been made possible by research and technical development, and, to an increasing though still somewhat limited extent, the results of this work have been successfully applied in practice. The conclusion has accordingly been reached that it is urgently desirable to secure an improved standard of illumination generally, and the following outline of proposals to that end (which are intended to form the basis on which general regulations can be framed) has been prepared by the Department's technical advisers, and has been communicated for discussion to the representative Associations of the coal-mining industry and to the principal manufacturing interests concerned.

Safety Lamps.—Every one shall give light at the end of 9 hours' burning such that the horizontal candle power, measured as an average over the actual area of distribution of the light, shall be not less than the minimum hereinafter specified; and the distribution of the light shall be sufficient and suitable.

(1) On and after June 30th, 1931, every *new* flame safety lamp	1.0
(2) On and after January 1st, 1934, every flame safety lamp in use at a mine	0.8
(3) On and after June 30th, 1931, every *new* electric safety lamp	1.3
(4) On and after January 1st, 1934, every electric safety lamp in use at a mine	1.0

The higher standards (1.0 for flame lamps and 1.3 for electric lamps) are proposed as laboratory testing standards for new lamps for purposes of official approval. The lower standards (0.8 for flame lamps and 1.0 for electric lamps) are proposed as standards of actual lighting efficiency in the pits. It is proposed to allow a period of approximately three years for the improvement, or replacement, of lamps at present in use which fall below these standards. Tests are in progress with a view, if considered desirable, to defining these standards in terms of mean spherical candle power, *i.e.*, in terms of the total amount of light given out by the lamp, instead of the amount of light in only one plane.

The foregoing provision shall not apply to types of safety lamp approved under Section 33 of the Coal Mines Act, 1911, for use by officials only, or for special purposes only, under conditions (including a condition as to lighting) to be laid down in the Approval Order. The lighting efficiency of every safety lamp in use at a mine shall be adequately maintained, and all electric safety-lamp bulbs taken into use after June 30th, 1931,

shall have a lighting efficiency at the rated voltage in lumens per watt not less than the standard fixed by the current British standard specification for bulbs of that voltage. This means that, for the time being, 2-volt bulbs must have a rated initial efficiency of 5.24 lumens per watt, and an average efficiency throughout life of 5.03 lumens per watt.

The lighting efficiency of electric safety-lamp bulbs of any rated voltage for which there is no British standard specification shall be not less than a standard to be prescribed by the Board of Trade after consultation with the appropriate Committee of the British Engineering Standards Association. Mine owners shall not be responsible for any breach of this provision if they have purchased bulbs on a written guarantee from the lamp or bulb maker. For the purposes of approval of a type of electric safety lamp under Section 33 of the Act, a bulb of the standard defined above shall be used for determining the candle power of the lamp.

Other Means of Direct Lighting.—It is proposed to revoke the first proviso to Section 32 of the Act and also General Regulations 78 and 132 (iv), thus leaving a clear field for allowing and regulating the use of electric and other forms of lighting (other than safety lamps) in "safety lamp" areas. It is proposed to provide, as an alternative to the opening words of Section 32 (1), that other safe means of lighting may be used in such places, subject to the following requirements:—

(i) Electric lighting *on roadways* to be permitted within the following limits, subject to the requirements of the Act and Regulations as to the use of electricity, and subject to the lamp bulb being hermetically sealed and enclosed in a substantial protective fitting, and subject to the use of armoured cable: (*a*) on roads ventilated by intake air up to within 300 yards of the first working place at the working face which the air enters; (*b*) on main return airways within 300 yards of the upcast shaft, if that shaft is regularly used for the purpose of winding persons or minerals, but not within 300 yards of the last working place at the working face which the air leaves; (*c*) if the divisional inspector is satisfied that the conditions on any roadway are safe for the use of electric lighting outside the limits prescribed in (*a*) and (*b*), by reason of the absence of inflammable gas and of the nature and/or method of support of the roof and sides (*e.g.*, steel arched girders), he may consent in writing to the use of electric lighting on that roadway, except within 100 yards of the working face.

(ii) Electric lighting, except as permitted by paragraph (i), *e.g.*, at the faces, will not be permissible generally, but will be permitted under favourable conditions, subject to special regulations requiring additional precautions to be taken.

(iii) Wherever the use of electrical machinery is permissible it shall be permissible, subject to the consent of the chief inspector of mines, to use also electric lamps in fittings built into, or forming part of, the structure of that machinery. Such lamps must be strongly protected and must be supplied with current by conductors contained wholly within the machinery.

(iv) The use for lighting of lamps other than portable safety lamps, or of systems of lighting, approved in each instance by the Board of Trade as being equally safe under working conditions as the use of safety lamps approved in pursuance of Section 33 of the Act, shall be permissible, subject to conditions to be laid down in the approval order, and those conditions, if the use of electricity is involved, shall be in substitution for the requirements of the Act and Regulations as to the use of electricity. This provision is intended to cover the use of so-called compressed-air lamps and possibly the use of large lamps (fed by storage batteries) which would not be regarded as "safety lamps" because they would be maintained in the pit and not in the surface lamproom.

Surface Lighting.—Effective provision shall be made for securing and maintaining sufficient and suitable lighting in every part of a mine above ground in which persons are working or passing.

Phase Advancers.

A Comparative Study of their Theory and Performance.

By J. J. RUDRA, M.A., Ph.D., Graduate I.E.E., and PROF. MILES WALKER, M.A., D.Sc., M.I.E.E.

(*Summary of a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHEN one of the authors read a paper on phase advancers before the Institution in 1909,* the main criticism urged against the use of appliances of this sort was based on the fear that we were attaching a commutating device to an induction motor, the great attraction of which was its freedom from commutation troubles. Since 1909 many phase advancers have been installed for various classes of work, and their performance from the point of view of commutation has been so satisfactory that one can safely say that, whatever objections there may be to the use of phase advancers, the difficulty of commutation is certainly not one of them.

One of the objections has been on the grounds of expense, and certainly these machines have in the past cost more than machines of standard design of similar size. In a more recent paper† an attempt was made to show that when the induction motor is specially designed for use with a phase advancer the saving in material and increased efficiency more than justify the addition from an economic point of view.

Phase advancers can be classified in two groups:—

(1) Those developing a voltage which is a function of the secondary *current* and has some phase relation with it; they therefore generate, or consume, an e.m.f. which is of the nature of an impedance rise or drop, and can be called "expedor" phase advancers.

(2) Those developing a voltage which is proportional to the secondary open-circuit *voltage* and has some phase relation with it; the component of this voltage at right angles to the slip e.m.f. sends through the secondary a current which is in phase with the magnetising current. They thus alter the magnetising current taken by the motor, or, in other words, the susceptance of the motor, and can therefore be called "susceptor" phase advancers.

Three well-known types of the first group are the Leblanc expedor having no field windings, the Kapp vibrator, and the series-wound Leblanc advancer. Two types of the second group are the frequency convertor and the induction regulator.

The authors first consider the effects of such devices when connected to an ideal motor having a circle diagram of infinite radius, and state simple relations between the angle of the advancer and the kVA required to do what is desired. The necessity for having an angle of lag instead of an angle of lead when running above synchronism is explained.

The complete theory of the expedor advancer is worked out from the equivalent circuit, and test results are compared with what might be expected from the theory. A comparison of advancers of different phase angles under different conditions is made to determine which is the best for a given purpose.

The equivalent circuit of the susceptor advancer is given, and from it the complete theory is worked out. It is not always easy to obtain the equivalent circuit of a machine. Originally obtained by an extension of the method used by the late Dr. C. P. Steinmetz for obtaining the equivalent circuit of a simple transformer, it is really a "method" and has been found extremely successful. It consists of obtaining the symbolic equations of the machine, or the combination, and, by suitably solving those equations, getting an equation of the form $E_1=f(Z)I_1$, where E_1=e.m.f. per phase impressed on the machine, and I_1=current per phase taken by the machine. Then, the form of $f(Z)$ will indicate what the equivalent circuit is. The authors apply this method to an induction motor coupled to a frequency convertor, and after obtaining the circuit show how it can be obtained from simple considerations.

The authors regret that through lack of time they are unable to include in this paper a considerable amount of matter dealing with phase advancers which is in their possession. It is hoped that this will be available for publication at a later date.

During recent years induction motors having a susceptor or expedor phase advancer built in each motor itself have been placed on the market under various trade names. Owing to the increasing importance of these motors and to fear of making this paper too long, the authors have decided to write a separate paper dealing with the theory and performance of such motors by the methods described in this paper.

The authors record their thanks to the High Commissioner for India for providing the phase advancer tested, to the Metro-

* M. Walker: "The Improvement of Power Factor in Alternating-Current Systems," *Journal I.E.E.*, 1908-9, vol. 42, p. 599.

† M. Walker: "The Improvement of Power Factor," *Transactions of the first World Power Conference*, 1924, vol. 3, p. 831.

politan-Vickers Electrical Co., Ltd., for the 50-h.p. induction motor-d.c. generator set, and to Messrs. A. A. Ashour, B.Sc. (London), and M. P. Mehta, M.Sc. (Tech.), for their valuable help in carrying out the tests outlined in this paper.

Discussion.

Prof. J. K. Catterson-Smith thought the paper indicated the value of the equivalent-circuit method of treatment. The excuse for its use, in spite of its drawbacks, was that it was a kind of universal language, which avoided confusion and inventors' use of "methods" of their own which others might not understand. There was, however, the risk that the equivalent-circuit method might "let one down," as its user might be apt to forget that an actual machine was being dealt with. The authors' designations—"expedor" and "susceptor"—were not happy. For small and squirrel-cage motors the use of series condensers would repay study.

Mr. D. B. Hoseason explained that theory was nothing more than a belief, or doctrine. Those who struggled on a mathematical basis would appreciate the amazing expression developed by the authors for the theory of the "expedor," or 130-deg. type of advancer; it was by such simple and brilliant things that progress was made. There was a tendency for vector algebra to replace vector diagrams. The paper added a new wing to the structure of electrical literature.

Dr. R. G. Jakeman did not like the way types of machines had been named. Why not call them shunt and series? Some of the test results were not clear, as they seemed to indicate that if the machine's losses were reduced there would be no leading component left at small loads.

Mr. L. J. Hunt was surprised that phase advancers had not been adopted more generally than they had. Power factor would become more and more important in future, and the condenser method of correction might become a serious competitor of phase advancers, but he could not see how they could be used in series.

Mr. N. Pensabene-Perez emphasised the seriousness of the power-factor evil and the need for its cure. Elaborate calculation was not necessary, for the induction-motor circle diagram was simple and had a direct message for the eye.

Prof. Miles Walker, in reply, maintained that the names they had chosen were, at least, as good as any others that had been suggested. When a new thing was produced it should be given a new name, which should be short; too many names now in use had several meanings. Commutation gave no trouble, as the frequency was low; it gave a free hand with the field and enabled the machine to be run either way round. Usually, trouble was due to current collection, not commutation. A full reply to all the questions asked would be communicated to the I.E.E. *Journal*.

Mr. C. C. Paterson, president, commented on the fact that the paper was the first the Institution had received from an Indian author, and he expressed the hope that more would follow from his countrymen.

Electric Ship Propulsion.

Some general considerations which indicate its suitability for small vessels.

By W. H. WOOLNOUGH.

(Extracts from a paper read before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.)

THE number of electrically-propelled ships sailing under all flags is now not less than 170, a total that should help to remodel the views of any who remain sceptical, or inclined to regard this system as experimental. The adoption of electrical propulsion for capital ships (about 20 warships are so equipped) may probably have been influenced by considerations other than technical ones; but its application to 149 merchant ships, from which commercial gain is the first and only consideration, is quite a different matter.

The author has never been an advocate of the general adoption of this system; but for certain classes of vessel it merits attention, and in some cases has shown superiority over any other available arrangement of machinery in all of the major factors governing the design of a payable ship.

The application of these notes is limited to ships of the class plying in narrow waters, on coastwise service where the harbour depths limit the draught, and to special-service ships, such as tugs, fire floats, self-discharging bulk carriers, special cargo vessels, dredgers, and yachts, because for most other small vessels direct propulsion either by steam or by oil engine appears at present to have the advantage. The prime movers will usually be chosen without regard to transmission methods. In the case of daily service vessels, among which may be included tugs and yachts, it may be taken as a *sine qua non* that, with the possible exception of those requiring fairly high power (say, 2,000 h.p. or more), Diesel machinery has advantages as regards low fuel and low standing and maintenance costs, rendering it superior to conventional types of marine steam machinery. Hitherto the higher powered vessels within this category have almost necessarily retained steam plant owing to the difficulty of procuring Diesel engines of proportions which could be accommodated, but electrical transmission provides a means of meeting this contingency.

Much that has been said in favour of gear transmission for ships is tenable also for electrical transmission when considering vessels of the type under discussion, whether for large or moderate powers, for it is seldom that engines, acceptable as to type and construction, of the required power, and having a rotational speed corresponding to the optimum propeller speed, can be obtained. Electrical transmission may be used as a reducing gear when engine speeds are high, or as an increasing gear to provide the high propeller speeds necessary for fast, or shallow-draught, vessels to be coupled to the lower-speed Diesel engines at present available. If, then, transmission losses be regarded, as indeed they should be regarded, as loss of power between the b.h.p. of the prime mover and the t.h.p. of the propeller, part, at any rate, of the electrical losses can usually be recovered in increased propeller efficiency. Moreover, engines need no longer be reversible and, in certain circumstances, may be run at constant speed. Not only does this tend to improved economy in fuel and maintenance, but it also permits of the adoption of engines of higher speed, less costly, and requiring less space. Hence the first cost and the weight of the electrical equipment may be partly, or wholly, offset. There is less difficulty in arranging the engine room within the limits of length imposed by considerations of subdivision. For short runs, the fuel expended is of less consequence and handiness in manœuvring assumes importance. Ease and rapidity of reversal, together with the high astern power afforded by electrical transmission, facilitate good manœuvring qualities, and bridge control adds materially to these.

Tug duties are particularly arduous from a propulsion point of view, for tugs are often called upon to exert their greatest towing effort at low, or even zero, speed, when the propellers are working at high slip; with a direct drive the engines are unable to develop full power, but motors may be designed to exert their full torque over a wide range of speeds. Manœuvring qualities are also very important in this class of vessel.

In passenger vessels having relatively large electrical loads for domestic and deck services, the entire auxiliary requirements can be derived from the main engines at minimum fuel cost, permitting the elimination of auxiliary engines, excepting a small emergency set. This adds to passenger comfort and is advantageous as to first cost and maintenance.

Most special-service vessels have a quantity of deck and auxiliary machinery, the power requirements of which sometimes approach, or even exceed, those of propulsion machinery; in some cases the heavy auxiliary load does not occur simultaneously with the propulsion load, and the same main engines and generators could be used to supply alternatively the one or the other.

One factor of some moment credited to electrical propulsion is the facility to select, whilst on service, the revolutions at which to run the propellers to meet the vagaries of load, weather, or of errors in propeller design. This factor may, however, prove two-edged if abused or misunderstood, for it permits of involuntarily overloading the engines, but the latter can be avoided by proper governing.

D.c. is equivalent to variable-speed reversible gearing, and a.c. to fixed-ratio reversible gearing. Control is simpler and the more complete with d.c. machinery, but d.c. is generally heavier and less efficient than a.c. machinery. However, the auxiliary generators of the former can be driven by the main engines and auxiliary engines, except a stand-by set for light harbour use, may be eliminated, thereby cancelling much of the discrepancy in weight; and as the prime mover of a d.c. set runs at constant speed, its low full-load consumption is retained over a wide range of power, offsetting part of the a.c. machine's superior efficiency.

If circumstances are such that steam turbines are preferred, either a.c. or d.c. transmission may be employed; but if there is a considerable auxiliary load, or considerable manœuvring is required, d.c. has much to recommend it; in this case a gear-driven generator would be employed. When Diesel engines are to be employed d.c. will almost invariably be used, the only exception being twin-screw ocean-going vessels with two Diesel engines, when only a very small amount of manœuvring may be required and a.c. machinery may be advantageous. It is noteworthy that the 111 Diesel-engined electrically-propelled ships all use d.c., with possibly two exceptions which were not essentially propulsion jobs.

For powers up to about 3,000 s.h.p. the efficiencies of a.c. and d.c. systems at full load are 93.4 and 87.7 per cent., respectively, overall between the prime mover and the output of the propelling motor at the shaft coupling; cable and switchgear losses are included.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

A Novel Wiring Job.

I was very much interested in "A Novel Wiring Job" described in your issue of December 26th, but I am sorry I cannot give it the credit for being the first of its kind in which miniature circuit breakers are used.

We have in this town a market hall, 170 ft. by 85 ft., in which the whole of the 55 lamps are controlled by such switches! Though the job was an experimental one, so far it has proved O.K., and I feel there is a great future for the use of the miniature circuit breaker; if not, at present for the control of individual lights in a house, I certainly think it could replace the main d.p. switch. I would go further and would, for a cheap and efficient heating-circuit job, loop-in all plug points from the main d.p. switch; this would at least double the effectiveness of the cable, and each plug point would be controlled by a 15-amp. plug and an automatic circuit breaker (manufacturers, please note). The switches used at the market hall are of a British free-handle type housed in two ironclad boxes.

I feel the time has come to cut out fuses, even on the smallest installation; they require a certain amount of skill in replacing and, though hair-pins are now becoming unusual, we have still with us sealing wire from petrol tins.

A. Preston.

Carmarthen, *December 27th*, 1930

The Liberty of the Subject.

In 1909, by the generosity of one resident, the village of Herstmonceux, Sussex, received a supply of electricity and 25 electric cookers, the only charge to cottagers being 2d. per kWh for a cooker and current and 10d. for light. The number of consumers (pre-war) was 100.

When a London company deposited the Cranbrook Electricity (Extensions, &c.), *Draft* Special Order, which tried to absorb the Herstmonceux area without compensation; *but, more important to the residents*, without guarantee to continue a supply in Herstmonceux, the Electricity Commissioners inserted a Section, No. 10, which Parliament confirmed on December 19th, 1928, specifying protection to the non-statutory Herstmonceux supply on condition that it became "authorised" within two years. Six months ago the Herstmonceux (Draft) Electricity Special Order was deposited. I had consulted every desire of the Electricity Commissioners ascertainable by direct contact, and endeavoured to purchase a bulk supply from the nearest cable guaranteed to be laid by the Weald Company. They replied they had no plans to extend nearer than seven miles from Herstmonceux, made no inquiry as to my demand, but "hoped in a few months to hear" that money would be supplied under the Development (Loans Guarantees and Grants) Act, 1929, when they would lay plans. I obtained consent to ask for a supply from Eastbourne, which was unable to fix a price, or to contemplate a supply for the next two years.

The Hastings Corporation was ready to give a bulk supply in 1930. Either 33,000 volts at the Ore grid sub-station point, or 11,000 volts between 3 and 4 miles from Herstmonceux at Ninfield was available for the immediate provision of cheaper and abundant electricity in Herstmonceux.

The Commissioners have refused to consider details or to state any reason.

Only when the local Women's Institute appealed to the Minister of Transport the Commissioners sent an inspecting engineer (December 17th) to examine the 21 years' old installation (which they had refused consent to reasonably supplement).

The Commissioners' engineer had no instructions to consider the proposal to obtain an up-to-date immediately available bulk supply from Hastings, but wanted to satisfy himself as to the possibilty of making the existing privately-owned plant and cables continue to supply *only those now receiving electricity*, and how that supply could be taken from the philanthropic owner (who also supplied recreation grounds for the village and built, at his own cost, a Victory Hall for their meetings) and given to the Company, which makes no definite offer to supply within several years any additional premises.

The statement was verbally made by the Company's representative that the Electricity Commissioners have a complete scheme for distributing throughout the whole area; but he had no explanation of the fact that neither the Commissioners nor the Central Board possess legal rights to distribute, except to inquire if I accused him of terminological inexactitude in five letters.

As I read the Acts of Parliament, I find no provision for:—

1. Confiscation.
2. Increasing the cost of electricity to consumers.
3. Preventing extension of supply where there is a supply and a further demand.

If the Commissioners were offering means to a quicker extension, a cheaper selling price, or a better system, I would have no cause for comment.

They must necessarily contemplate years of delay, higher selling price that the Hastings rural tariff, no immediate extension of supply, patching up worn out parts, and the only excuse verbally suggested is that Herstmonceux' protected area is surrounded by an authorised area—to which I retort that within seven miles of Herstmonceux no distribution exists of electricity by the supplier who for 48 years holds the monopoly, and he has written me he had no plans.

Theodore Stevens.

London, W.C.2, *December 19th*, 1930.

Standardising Porcelain Stickers.

It has been interesting to note the change in attitude of the electric stove manufacturers towards the use of vitreous enamel. Originally many of them adopted enamel against their will, simply because the trade demanded it. At that time enamel was not as good as now—it chipped more and warped more—scrap loss was higher. I am afraid many of the stove men considered it a nuisance.

After a time they realised that vitreous-enamelled parts were a great stimulant to sales and their attitude began to change. They then began to make every effort to cut down enamelling troubles by changing patterns and designs so that the enamelling could be done easier and better. More parts were brushed and the enamel was given every possible manufacturing advantage.

There is still trouble with salesmen, dealers, and consumers, who expect too much from the enamel; therefore, the writer recommends all porcelain enamel stove manufacturers to provide their finished product with a suitable sticker telling what enamel is and how it should be cared for. Perhaps a committee composed of three or four stove manufacturers could suggest a standard label for the consideration of all stove manufacturers. It could be placed on one corner of the splasher back.

A tentative form for this sticker is as follows:—

"Enamel is thoroughly inspected, and will give good service, if carefully handled. It is breakable and cannot be guaranteed. Never wash porcelain while warm. Remove any discolorations promptly, using soap and water; never use cleaning powder containing grit or acid. Always remove broiler pan from oven when not in use."

Another thought is a sticker for invoices, as follows:—

IMPORTANT NOTICE.

"This shipment contains porcelain enamel parts, and *should be uncrated and inspected as soon as received.*

"If damaged, and notification has not been made on freight bill, arrange immediately for inspection by representatives of transportation company at your warehouse, so that claim for damages can be placed."

E. W. Davy.

Wolverhampton, *December 16th*, 1930.

The Arapuni Scheme.

The following is an extract from the ELECTRICAL REVIEW of September 26th, 1930, page 502:—

> "New Zealand.—The Arapuni hydro-electric scheme.—The report of the Swedish expert, Professor Hornell, regarding the Arapuni hydro-electric scheme is now in the hands of the Government. It is understood that the professor does not condemn the scheme, *which has proved somewhat disappointing mainly owing to the abnormal lack of rainfall in the Lake Coleridge watershed.*—Reuter (Wellington)."

The portion in italics is in error; Arapuni is in the North Island, and Lake Coleridge is in the South Island. It is disappointing to find the ELECTRICAL REVIEW repeating a confusion of this nature. The remarks also tend to convey that it is disappointing that the professor commended the scheme.

G. L. Payne.

Matamata, New Zealand, *November 5th*, 1930.

Prevention of Accidents.

May I again trespass on your space, this time with an apology?

Dr. Ekstrom's letter published in your issue of the 19th instant so puzzled me, and at the same time created that uncomfortable feeling of being "wiped out," that I had to read both it and my own several times before discovering the clue.

I gather that Dr. Ekstrom has taken my query as to "British brains" as a personal affront, and the rest of my letter as the vapourings of an inexperienced amateur. I have for years looked up to Dr. Ekstrom as one of *our* foremost electrical writers and consultants, and if I had thought for a moment that my remarks would be read so narrowly I should have been more careful to write "Surely we have plenty of *brains in Britain. . . .*" I trust Dr. Ekstrom will accept my assurance that I had, and have, only the greatest respect for him and his opinions, and I apologise for having unintentionally caused him to think otherwise.

With regard to Dr. Ekstrom's letter generally, I may fairly claim that during 35 years of practical electrical work I have gained a certain amount of experience, and the views I put forward are based on observation, practical experiment, and research. Further, I fully agree with Dr. Ekstrom that we should continue our endeavours to educate the public in safety methods, but I would ask what chance of success there is when (1) those who are experts practically confine their writing to technical journals; (2) the easiest safety arrangements are considered "too simple" to bother about; (3) the electricity showrooms, shops (multiple *and electrical*), are full of devices, especially at this season, and newspapers full of advertisements of such articles, *not one of which is fitted by the maker with means for rendering it safe?*

I have made a round of stores and have seen thousands of domestic irons, toasters, kettles, bowl fires, hair driers, hair wavers, and the like, all provided with lampholder adaptors on twin flexible cords, but nowhere have I seen or heard any kind of warning to the would-be purchasers.

I can assure Dr. Ekstrom that the method I advocated, and have proved by long experience, *is quite as simple and effective as I believed*, and I am daily pointing it out to contractors and householders in all parts of the country.

Bexley, *December 23rd*, 1930.

G. S. Boothroyd.

"A Note on Electrical Theory."

It is not a serious fault if the writer of a scientific article is somewhat inaccurate in historical references, but when the article is purely historical in character, then inaccuracies cannot be tolerated. Because of this, I venture to correct some errors in the article by Mr. Windred entitled "A Note on Electrical Theory."

Speaking of Heaviside's method, the writer states that England is represented by J. R. Carson, Van der Pole, and the late Dr. T. J. I'A. Bromwich, but that America is much better represented by E. J. Berg and L. Cohen. The actual position is that J. R. Carson is America's most powerful and original contributor to the Heaviside method, and has written the best book on its electrical applications, *viz.*, "Electrical Circuit Theory and Operational Calculus." England is well represented by T. J. I'A. Bromwich and Dr. H. Jeffreys, who has written an extraordinarily good booklet, published by the Cambridge University Press, entitled "Operational Methods." Germany has also been prominent, especially in electrical applications, in the persons of K. W. Wagner and H. Salinger.

It is true that omissions are often unavoidable, but when the omissions cause an unfair picture to be presented, then either the whole or nothing should be said.

Further, there is a subject called telephony, with its pioneers, apart from Heaviside. Some mention should have been made of the work of G. A. Campbell, of America, and K. W. Wagner, of Berlin. Six lines from Steinmetz and three lines from Kennelly might safely have been filched for this purpose.

A. T. Starr.

London, N.W. 4, *December 24th*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

16,585. "Alternating current dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. H. Maggs. May 29th, 1929. (339,273.)

19,075. "Electric switchgear." Electric Construction Co., Ltd., and W. N. Ringrose. March 21st, 1930. (339,231.)

22,670. "Electric signalling systems." Siemens & Halske Akt. Ges. July 30th, 1928. (316,553.)

23,268. "Production of continuously burning, parallel-arranged electric arcs." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). July 29th, 1929. (339,329.)

23,300. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. July 29th, 1929. (339,277.)

23,990. "Oil switches." International General Electric Co., Inc. August 7th, 1928. (316,979.)

24,141. "Gaseous electric conduction apparatus." Raytheon, Inc. August 24th, 1928. (317,849.)

25,674. "Motor vehicles for refuse collecting." Electricars, Ltd., J. W. Treece, and C. E. Jones. August 23rd, 1929. (339,241.)

26,073. "Totalisators." Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. August 27th, 1929. (339,254.)

26,074. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett and C. Gillings. August 27th, 1929. (339,279.)

26,191. "Electrical discharge devices." British Thomson-Houston Co., Ltd. September 26th, 1928. (319,686.)

26,717. "Electrical condensers and the method of making the same." H. I. Danziger. September 3rd, 1929. (339,306.)

26,752. "Submarine electric signalling cables." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). September 3rd, 1929. (339,262.)

26,753. "Two-way terminal circuit for telephone cables." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). September 3rd. 1929. (339,288.)

26,754. "Sealing devices for use with electric cables and other apparatus." British Insulated Cables, Ltd., and W. Holttum. September 3rd, 1929. (339,263.)

26,779. "Automatic regulator systems for electric circuits." T. B. Somerville and Associated Electrical Industries, Ltd. September 3rd, 1929. (339,289.)

26,790. "Electric receiving and/or signalling apparatus." Siemens Bros. and Co., Ltd., and H. E. Humphries. September 3rd, 1929. (339,265.)

26,935. "Electrical signalling apparatus." Relay Automatic Telephone Co., Ltd., British Power Railway Signal Co., Ltd., and T. M. Inman. September 5th, 1929. (339,308.)

27,004. "Loud-speaker unit." A. I. Abrahams. May 21st, 1929. (339,312.)

27,040. "Tell-tale systems such as gas-detection systems or the like." Standard Telephones and Cables, Ltd., S. Chapman, and E. M. S. McWhirter. September 5th, 1929. (339,315.)

27,053. "Systems of control for alternating-current electric motors." Electrical Research Products, Inc. September 19th, 1928. (Addition to 320,889.) (319,274.)

27,059. "Wireless receivers." Gramophone Co., Ltd., and R. K. Spencer. September 5th, 1929. (339,316.)

27,064. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. T. Belas. September 5th, 1929. (339,318.)

27,065. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. September 5th, 1929. (339,345.)

27,746. "Filament-tension means for thermionic valves and electric incandescent lamps." British Thomson-Houston Co., Ltd. September 12th, 1928. (318,933.)

27,803. "Testing appliances for ignition systems." C. F. Styles. September 12th, 1929. (339,369.)

27,977. "Electric switch-operating mechanism." British Thomson-Houston Co., Ltd. September 14th, 1928. (319,018.)

27,978. "Pneumatic blow-outs for electric switches." International General Electric Co., Inc. September 14th, 1928. (319,019.)

28,102. "Insulated electric cable conductor and the like." C. W. Bloomfield. September 16th, 1929. (339,375.)

28,490. "Motor for loud-speakers." Farrand Inductor Corporation. September 25th, 1928. (319,665.)

28,547. "Alternating current cables." W. W. Triggs (Felten & Guilleaume Carlswerk Akt. Ges.). September 25th, 1929. (339,383.)

28,924. "Differential gear for driving spindles of wireless apparatus independently from the direction of rotation of the control knob." H. Defrance. July 12th, 1929. (339,389.)

28,960. "Sectional electrostatic sound producer." United Reproducers Patents Corporation. January 4th, 1929. (339,391.)

29,384. "System of wireless-telegraphy and telephony." Telefunken Ges. für Drahtlose Telegraphie. September 28th, 1928. (319,786.)

29,581. "Electric tapping switches." H. Diggle, J. Fowler, and Associated Electrical Industries, Ltd. September 30th, 1929. (339,400.)

31,439. "Electrical discharge tube amplifiers." General Electric Co., Ltd., and D. A. Oliver. October 16th, 1929. (339,415.)

32,243. "Sheaths for electric cables and other tubular bodies." C. J. Beaver and W. T. Glover & Co., Ltd. October 23rd, 1929 (339,425.)

32,383. "Method of, and apparatus for, making articles by electrolytic deposition of galvanoplastic metal." G. Rosenqvist. October 24th, 1929. (339,428.)

32,728. "Distribution of electrical signals." A. Warwick, J. A. Taylor, and H. C. Holmes. October 28th, 1929. (Addition to 319,984.) (339,430.)

32,759. "Electrical indicating devices." W. Altner. December 10th, 1928. (339,451.)

32,935. "Trucks for tramway and other rail vehicles." Electro-Mechanical Brake Co., Ltd., and L. A. Catlin. October 30th, 1929. (339,433.)

32,989. "Selecting switches such as used in automatic telephone systems." Siemens Bros. & Co., Ltd., C. R. Riber and T. H. Jones. October 30th, 1929. (339,434.)

33,411. "Sound-reproducing apparatus." Federal Telegraph Co. and W. M Brower. November 2nd, 1929. (339,438.)

34,875. "Electron emitting cathodes for electric discharge devices." Gramophone Co., Ltd., and G. B. Baker. November 14th, 1929. (339,451.)

35,346. "Radio signalling systems." Marconi's Wireless Telegraph Co., Ltd. November 19th, 1928. (339,459.)

35,452. "Cooling device for electric motors." G. Pellizzari. November 20th 1929. (339,461.)

35,722. "Electric heating elements." G. Wilkinson. November 22nd, 1929 (339,464.)

36,055. "Treatment of bitumen, bituminous preparations, tar, and the like for electrical and other uses." D. Anderson & Son, Ltd., and R. O. Child. November 25th, 1929. (339,470.)

36,565. "Adjusting means for rotatably-mounted electrical component." Gramophone Co., Ltd., and A. G. D. West. November 28th, 1929. (339,478.)

37,695. "Telephone systems." Coventry Automatic Telephones, Ltd, and B. F. Moss December 9th, 1929. (339,493.)

37,846. "Construction of electric motors." H. H. Kalber. December 10th. 1929. (339,495.)

37,931. "Switching arrangements for automatic and semi-automatic telephone systems." Telefonaktiebolaget L. M. Ericsson, A. Rosa, and K. G Johnson. December 10th, 1929. (339,496.)

38,041. "Radio receiving systems." Marconi's Wireless Telegraph Co., Ltd. December 11th, 1928. (339,499.)

38,552. "Preparation of magnesium by electrolysis." C. Arnold (Dow Chemical Co.). December 16th, 1929. (339,504.)

39,333. "Electric tubular lamp and method of making the same." Plechati-Gluhlampenfabrik. October 25th, 1929. (339,513.)

39,613. "Electro-magnetically controlled pumps." J. L. L. A. A. Moulet. December 27th, 1929. (339,518.)

39,628. "Electric fuses." J. A. Crabtree and J. R. Dolphin. September 7th, 1929. (Divided application on 32,453/28.) (339,358.)

1930.

609. "Electrical interlocking switches for power boards." Standard Telephones and Cables, Ltd., and G. F. Goddard. January 7th, 1930. (339,525.)

1,092. "Electric transformers." Ferranti, Ltd., and J. Turner. January 11th, 1930. (339,527.)

3,248. "Flameproof casings for electrical apparatus." Siemens-Schuckertwerke Akt. Ges. January 31st, 1929. (339,541.)

4,597. "Thermionic amplifiers." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). September 3rd, 1929. (Divided application on 339,288.) (339,269.)

4,598. "Terminal transmitting circuits for thermionic amplifiers." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). September 3rd, 1929. (Divided application on 339,288.) (339,270.)

5,833. "Electron discharge devices." British Thomson-Houston Co., Ltd. February 21st, 1929. (339,559.)

10,224. "Electrical connector." R. W. James (Connecticut Telephone and Electric Corporation). March 31st, 1930. (339,580.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Fish market extension scheme (£37,800); engineer, Harbour Commission.

ABINGDON.—Water supply scheme, with pumping station and plant, for the R.D.C.; Guthrie Allsebrook, engineer, 29, Crown Street, Reading.

AMERSHAM.—Houses (56) for the R.D.C.; Burgess, Holden and Watson, architects, Beaconsfield.

AUDENSHAW (LANCS.).—Works extensions, Providence Street, for J. Downs & Son.

AXBRIDGE.—Water supply scheme with pumping station and plant for the R.D.C.; Parker Pearson & Ross Hooper, engineers, Dallas Chambers, Chippenham.

BARKING.—Lacquer and plastic compounds factory, Harrow Road; Huws Manufacturing Co.

BERKSHIRE.—Schools, Drayton & Finchhampstead, for the county E.C.; director of education, Reading.

BEXHILL-ON-SEA.—Houses, St. James' Road; Strange and Sons, Terminus Road.

BLACKPOOL.—Houses (1,000), Highfield Road; borough surveyor.

BOLTON.—Block of shops and offices (£80,000) at the junction of Oxford Street and Deansgate; J. Gerrard & Son, Ltd., builders, Swinton, Manchester.

BOURNEMOUTH.—Rebuilding premises, Old Christchurch Road; Brights, Ltd. School, Ensbury Park, for the E.C.

BRIGHTON.—Rebuilding 181-2, Western Road, for F. W. Woolworth & Co., Ltd.; T. Garrett & Son, architects. Workshops, Hollingbury Road; Pullars Electric Co., Ltd.

CANTERBURY.—Reconstruction of business stores, The Parade, for Boots, Ltd., Nottingham.

CASTLEFORD.—Houses (300) for the U.D.C.; surveyor.

CROYDON.—Extensions, Mayday Road Infirmary; Mr. Berney, architect. Offices, &c., Cherry Orchard Road; Wallis, Gilbert & Partners, architects. Oil depôt, Purley Way; Anglo-American Oil Co., Ltd. Four shops, Mitcham Road; H. Macintosh, architect.

DURHAM.—Installation of electric lighting at schools at Bishop Auckland, Marsden, Consett, Newfield, Stanley (Crook), Witton Gilbert, Hookergate, and Chester-le-Street, for the E.C.

EDINBURGH.—Junior school for Trustees of George Heriot's School; George Reid, architect.

ESTON.—Houses (500) during the next five years; U.D.C. surveyor.

GLASGOW.—Shop buildings at Bishopbriggs for Cowlairs Co-operative Society, Ltd.; the manager.

GODALMING.—Houses (200) for the T.C.; borough surveyor.

GRIMSBY.—Cattle market (£11,617); Hewins & Goodhand, Grimsby.

HANTS.—Senior school, Botley, for the county E.C.; director of education, Winchester.

HYDE.—Bakery, Gee Cross, Hyde, for R. Wilson, Ltd., High Street West, Glossop; William Norgrove & Sons, Ltd., builders, Kirkley Saw Mills, Hyde.

JARROW-ON-TYNE.—Rebuilding of premises, Ormonde Street, for F. W. Woolworth & Co., Ltd.; C. S. M. Beardall, architect, 59, Wellington Road, New Brighton.

KENT.—Extensions, Tonbridge Institution (£40,800); nurses' home, Maidstone Institution (£14,000); and laundry, with plant, Bromley (£31,273), for the Public Assistance Committee; clerk, Maidstone.

LANCASHIRE.—Senior school, Upholland, for the county E.C.; director of education, Preston.

LEIGH.—Senior school, Manchester Road (640 places); A. Brocklehurst & Co., architects, Martin's Bank Buildings, 10, Norfolk Street, Manchester. Senior school, Westleigh Lane (320 places); J. C. Prestwich & Sons, architects, Bradshawgate Chambers, Leigh.

LIVERPOOL.—Offices and warehouse, pierhead; Great Western Railway Co.

LONDON (ILFORD, E.).—Houses (128), Brockenhurst Gardens; T. B. Goodwin, Ltd. Houses (72), Mansted Gardens; F. Smith. Houses (63), Reynolds Avenue; C. & G. Contractors, Ltd. Factory extensions, Grove Road; Fuller Accumulator Co., Ltd. Despatch warehouse, Roden Street, for Ilford, Ltd.; A. F. Royds. Shops and showrooms, Ley Street; W. J. Lewis.

(POPLAR, E.).—Factory, Campbell Road; Tucker & Huntley. Laboratory, Three Mill Lane; Kemball, Bishop & Co.

(ST. PANCRAS, N.W.).—Tenements, &c., Cumberland Market; principal architect to Commissioners of Crown Lands.

(WILLESDEN, N.W.).—Children's ward and X-ray block, at Park Royal Hospital, for the Middlesex C.C. Public Assistance Committee (£50,000); Couzens & Brown, engineers.

(BECKENHAM, S.E.).—Municipal buildings (£73,000); Lanchester & Lodge, architects.

(CLAPHAM, S.W.).—Maternity hospital, Poynders Road; L.C.C. Public Assistance Committee.

(WESTMINSTER, S.W.).—Flats, Pulford Street; Westminster Housing Trust, Ltd. Health centre, Marsham Street; City of Westminster Health Society.

(CHARING CROSS, W.C.).—Rebuilding 17-21, Northumberland Avenue; Hart & Waterhouse.

LONGTON (STAFFS.).—Houses (266), Lightwood Chase; J. W. Thornley & Sons.

LOWESTOFT.—Houses (108) for the T.C.; William Tickner, builder, Moulscombe, Brighton.

MERTON & MORDEN.—Extensions, Council offices; U.D.C. surveyor.

MIDDLESEX.—Elementary school, Sudbury Park Farm, Alperton, for the county E.C.

MONTROSE.—Nurses' home at Asylum (£30,000); W. C. Orkney, clerk of works, Montrose Asylum.

MORECAMBE.—Hotel, harbour site; L.M.S. Railway Co.

PADGATE.—Elementary school (300 places) for the Rev. Father Thomas S. Hind; Wright & Hamlyn, architects, Patten Chambers, 20, Winmarleigh Street, Warrington.

PENRITH.—Houses (50) for the U.D.C.; surveyor.

PERTH.—School, Cherrybank, with heating and electric lighting installations; A. Watt Allison, architect, Education Offices, Perth. School, Scone; clerk of works, E.C., Perth.

ROCHDALE.—Rebuilding of premises, Edenfield Road, Norden, for the Rochdale Equitable Pioneers' Society, Ltd., Toad Lane; T. Ashworth & Sons, Ltd., builders, Norden, near Rochdale.

ROCHESTER.—Two senior schools for the city E.C.; director of education.

SOUTHPORT.—Market; H. Langman, architect. Maternity hospital, Curzon Road; borough engineer.

SUNDERLAND.—Rehousing scheme, Well Dean estate; borough engineer.

TUNBRIDGE WELLS.—Housing scheme (15 acres), Rusthall Grange; borough engineer.

WARLINGHAM.—Extensions, mental hospital (£58,000); J. M. Sheppard, architect to the Croydon Corporation.

WORCESTER.—Schools and extensions (£100,000) for the city E.C.; director of education.